

**AN APPRAISAL OF DETERMINANTS AFFECTING GRADE 9
LEARNERS' SELECTION OF SUBJECTS IN THE FIELD OF
TECHNOLOGY FOR THE FET PHASE IN THE SEDIBENG AREA**

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DECLARATION

I JAN ADRIAAN KRUGER, solemnly declare this dissertation entitled: AN APPRAISAL OF DETERMINANTS AFFECTING GRADE 9 LEARNERS' SELECTION OF TECHNOLOGY SUBJECTS FOR THE FET PHASE IN THE SEDIBENG AREA is original and the result of my own work. It has never, on any previous occasion, been presented in part or whole to any institution or Board for the award of any degree. I further that all information used and quoted have been duly acknowledged by means of complete reference.

Signature: _____

Date: _____

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SUMMARY

Title: An appraisal of determinants affecting grade 9 learners' selection of Technology subjects for the FET phase in the Sedibeng area

Keywords: Technology, technology education, Technology as field of study, the South African school curriculum, subject selection, subject choice

Notwithstanding the possibilities offered by FET subjects in the field of Technology, the selection of these subjects is not very common which results in a shortage of skilled trade workers, impacting negatively on the country's economic growth. The researcher was therefore interested to establish the determinants affecting Grade 9 learners' selection of subjects in the field of Technology for the FET Phase in the Sedibeng area. By means of a literature and empirical study the aforementioned was investigated.

In the literature study, which provided the foundation for the study, the rationale and value of Technology education and its infusion in the South African school curriculum were explored. This was followed by an examination of possible factors impacting on learners' subject choice. The literature study was concluded by providing a concise outline of subject choices in the field of Technology as specified by the Department of Basic Education.

The empirical study was based on a sequential explanatory mixed methods research design. The research consisted of two parts. A quantitative survey, using self-developed questionnaires, was conducted in 17 schools among 10 Grade 9 Technology teachers and their learners (n=388) in two districts of the Sedibeng area. This was followed by a qualitative, phenomenological study in which three Technology subject facilitators working in the same area were interviewed.

By applying a factor analysis, the quantitative research results revealed that central and peripheral factors affecting Grade 9 learners' selection of subjects in the field of Technology for the FET Phase in the Sedibeng area could be distinguished. The central factors included the following: competent, compassionate teachers, the personal and developmental value of the subject, stimulation and the distribution of information regarding the subject. The range of subjects for the FET phase in the

field of Technology offered by schools, the complexity level of subjects in the field of Technology, personal interest in a subject and future prospects offered by a subject constituted the peripheral factors. The qualitative findings were used to clarify, refine, explain and extend the quantitative results. The research participants in this part of the study indicated that much could still be done to enhance the competence and compassion of Technology teachers, that the value of Technology education should be better justified and that the availability and quality of resources in the field of Technology education deserves attention. There is thus evidence that much must still be done to make the selection of subjects in the field of Technology more attractive to learners.

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CHAPTER ONE

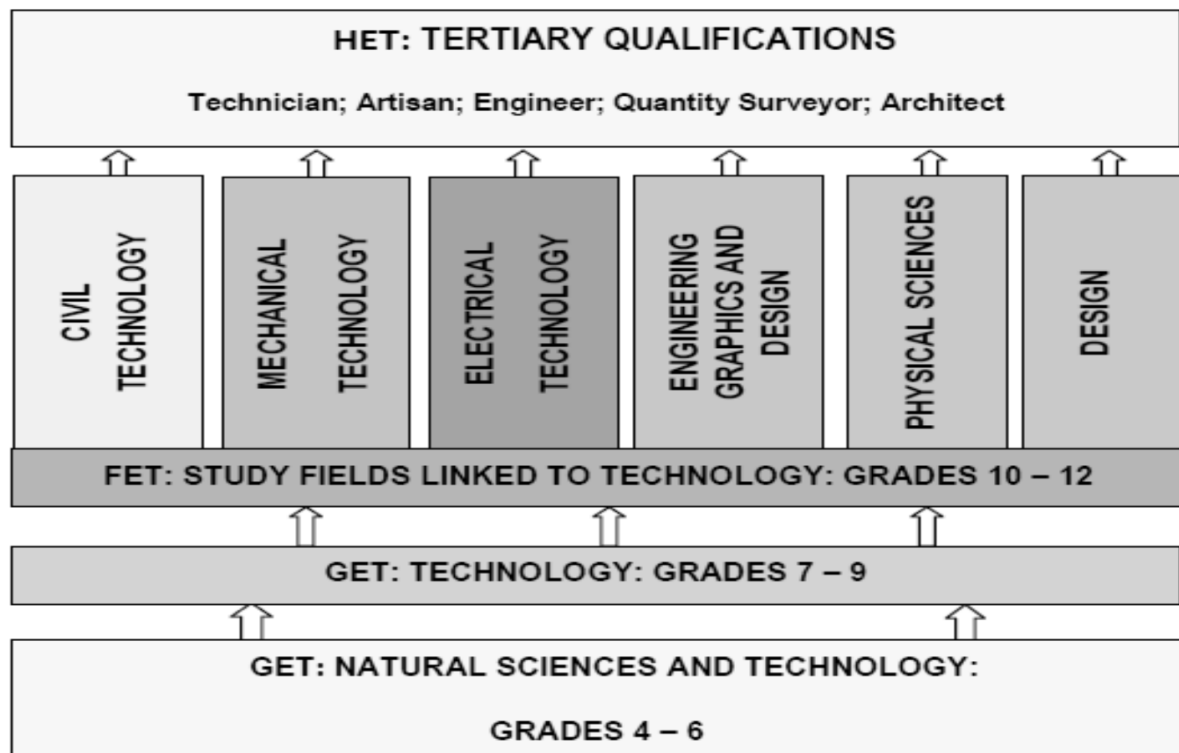
INTRODUCTION AND MOTIVATION OF THE STUDY

1.1 INTRODUCTION AND MOTIVATION FOR THE STUDY

Globally, technological advancement has surpassed all expectations and predictions. Consequently, South Africans also need to keep abreast on this terrain to be able to compete internationally (Pudi, 2007:25). In recognition of this need, Technology education was introduced into the South African school curriculum in order to produce engineers, technicians and artisans needed in modern society, but also to develop a technologically literate population, able to survive in the modern world. Through the implementation of Curriculum 2005 (C2005) and the National Curriculum Statement (NCS), the Technology Learning Area was accepted as one of the eight core learning areas for the General Education and Training (GET) band. In other words, it became compulsory from the Intermediate Phase (Grades 4 – 6) up until the Senior Phase (Grades 7 – 9). The former status attached to Technology was continued in the current Curriculum and Assessment Policy Statements (CAPS) where the subject is offered in combination with Natural Science in the Intermediate Phase and as an independent subject in the Senior Phase.

According to the CAPS (Department of Basic Education (DBE), 2010) the subject Technology, stimulates learners to be innovative and develops their creative and critical thinking skills. Furthermore, it teaches learners to manage time and material resources effectively, and provides opportunities for collaborative learning and teamwork. It is argued that these skills provide a solid foundation for many Further Education and Training (FET) subjects, as well as for the world of work (DBE, 2010:9). Technology as subject in the Senior Phase (Grades 7 – 9) aims to introduce learners to the basic knowledge and skills needed for FET subjects such as Civil Technology, Mechanical Technology, Electrical Technology and Engineering Graphics and Design (DBE, 2011a:8). It is also envisaged that Technology education will provide learners with some experience to enable them to make informed career-oriented subject choices at the end of Grade 9 (DBE, 2011a:8). The progressive culmination of Technology from the GET to the FET band and how it eventually could make provision for higher education studies is depicted in Figure 1.1.

Figure 1.1: The culmination of Technology from the GET and FET bands into higher education (Adapted from DBE, 2011a:9)



In this figure it is clear that Technology is introduced as a combined subject with Natural Science in the Intermediate Phase where after it is taught as an autonomous subject in the Senior Phase. In the FET Phase, covering Grades 10 to 12, learners can proceed with their education in the field of Technology by selecting from the following subjects:

- Civil Technology
- Electrical Technology
- Mechanical Technology
- Engineering Graphics and Design.

In combination with pre-requisite subjects, such as Physical Science and Design, a selection of these subjects in the field of Technology could allow a learner entry to higher education studies.

Based on the Education Management Information System (EMIS) data for 2012 (DoE, 2012), the number of secondary schools in the Sedibeng East (D7) and Sedibeng West (D8) Districts was determined. In addition, the EMIS data were used to ascertain how many of these schools offer any of the mentioned subjects in the

field of Technology in the FET Phase and how many FET learners out of the total enrolment at all the schools in the area choose one of these subjects for their FET schooling career. The data were also used to establish the number of Grade 10 learners who selected a subject in the field of Technology for the FET Phase in relation to the total number of Grade 10 learners in the two districts. The data are reflected in Table 1.1 below.

Table 1.1: The learner to Technology subject ratio in the Sedibeng East and West Districts (DoE, 2012)

	Sedibeng East (D7)	Sedibeng West (D8)
Secondary Schools in the district	42	49
Secondary Schools in the district that present any one subject in the field of Technology in the FET Phase	10	7
Number of learners that registered for Gr. 10-12 in 2012	11301	25991
Number of learners who chose a subject in the field of Technology for Gr. 10-12 during 2012	2130 (18%)	1854 (7%)
Grade 10 learners registered for 2012	5111	12266
Grade 10 learners registered for any one of the subjects in the field of Technology in the FET Phase during 2012	969 (19%)	786 (6.4%)

From the data reflected in Table 1.1 the little interest in FET subjects related to the field of Technology in the Sedibeng East (D7) and Sedibeng West (D8) Districts is evident; reflecting a mere total of 25% of FET learners in both districts registered for one of these subjects. To supplement this information, and by considering a time span of four years, it appears as if the popularity of subjects in the field of Technology as compared to seven other elective subjects amongst FET learners is significantly lower. However, it is noteworthy that Engineering Graphics and Design is the most popular FET subject in the field of Technology, while Electrical Technology appears to be the least popular. These realities are illustrated in Table 1.2.

Table 1.2: A comparison between the choice of Technology subjects and other elective subjects (DBE, 2011b:59)

Subjects	2008	2009	2010	2011
Life Sciences	298 210	298 663	285 496	264 819
Business Studies	204 963	206 553	200 795	187 677
Civil Technology	9 435	9 576	9 108	8 227
Physical Science	217 300	220 882	205 364	180 585
Electrical Technology	6 991	6 354	5 843	4 836
Engineering Graphics and Design	25 301	25 578	25 880	23 824
Geography	214 299	215 120	209 854	199 248
Mechanical Technology	7 525	7 093	6 859	5 831
Mathematical Literacy	267 236	277 677	280 836	275 380
Mathematics	300 008	290 407	263 034	224 635
Tourism	70 406	74 564	78 488	84 354

It is a further well-known fact that South Africa has a high unemployment rate and a shortage of a technological skilled workforce. According to the World Bank (2010:99) a shortage of skills in the field of Technology is one of the key obstacles to a country's economic growth. Confirming this standpoint is the fact that the Mining and Mineral Sector (MMS) is dependent on the availability of specific professional and technical skills in order to grow (Mining Qualifications Authorities (MQA), 2012:2). However, the report of the MQA (2012) on scarce skills draws attention to the shortages experienced nationally in 2011 in the different technological related occupations as reflected in Table 1.3.

Table 1.3: Scarce skills shortages according to occupation: June 2011 (MQA, 2012:11)

Occupational Category	Occupation	Level	Shortage 2011
Skilled Trades Workers	Fitter-Welder	FET	34
	Metal Fabricator	FET	74
	Rigger	FET	0
	Fitter and Turner	FET	18
	Diesel Mechanic	FET	104
	Electrician	FET	90
	Millwright	FET	27
	Mechatronics Technician	FET	26
	Electronic Instrument Trades Worker	FET	11
	Automotive Electrician	FET	14
Plant and Machine Operators and Assemblers	Fitter (General)	GET	83

1.2 PURPOSE STATEMENT

In the light of the information mentioned above, it is evident that despite the possibilities offered by FET subjects in the field of Technology, the selection of these subjects is not very common which results in a shortage of skilled trade workers. According to the Department of Education of the United Kingdom (2009), it is vital that subject choices made by learners be thoroughly understood and researched since such choices may have profound implications for learners' later-life education and economic opportunities. In South Africa, information on learners' subject choices, especially in the field of Technology education, is still limited. The researcher identified this as a research opportunity and is therefore interested to determine the possible factors that impact on Grade 9 learners' decision to include subjects in the field of Technology in their FET curriculum. Derived from this

interest, the purpose of the study is to appraise the determinants affecting Grade 9 learners' selection of subjects in the field of Technology for the FET Phase in the Sedibeng area.

1.3 RESEARCH QUESTIONS

To realise the purpose of the study, the research was guided by a range of research questions and objectives.

1.3.1 Primary research question

The primary research question was formulated as follows:

What are the determinants affecting Grade 9 learners' selection of subjects in the field of Technology for the FET Phase in the Sedibeng area?

1.3.2 Secondary research questions and objectives of the study

Emanating from the primary research question, the following secondary research questions were formulated:

- What is the rationale for, and value of Technology education as part of the South African school curriculum?
- What is the nature of Technology as field of study in the South African school curriculum?
- What influences learners' subject choices?
- What are the understanding and attitudes of GET teachers teaching Technology, regarding the subject?
- What are the perceptions of learners in the GET Phase, about the subject Technology?
- What are the concerns of Technology subject facilitators regarding the viability and sustainability of Technology as field of study?

Inferred from the secondary research questions, the matching objectives imply:

- the determination of the rationale for, and value of Technology education as part of the South African school curriculum;
- the clarification of the nature of Technology as field of study in the South African school curriculum;
- establishing the factors which influence learners' subject choices;

- uncovering the understanding and attitudes of Technology teachers teaching the subject in the GET Phase, regarding the subject;
- ascertaining the perceptions of learners in the GET Phase about the subject Technology, and
- discovering the concerns of Technology subject facilitators regarding the viability and sustainability of Technology as field of study.

1.4 CONCEPTUAL FRAMEWORK

The conceptual framework on which this study was founded centred on **Technology as field of study in the South African school curriculum and subject choice**¹.

1.4.1 Technology as field of study in the South African school curriculum

In the context of the South African school curriculum, Technology as field of study is defined as “The use of knowledge, skills, values and resources to meet people’s needs and wants by developing practical solutions to problems, taking social and environmental factors into consideration” (DBE, 2011a:8). Technology education focuses on understanding the need for human-made objects and environments to solve problems (DBE, 2011c:9) and aims to stimulate learners to create structures, systems and processes to meet the needs of people and to improve the quality of life (DBE, 2011c:9). In the educational context, it is anticipated that Technology as subject in the GET Phase would enhance learners’ technological literacy by providing them with opportunities to develop knowledge, skills and attitudes related to the field of study. Moreover, it is also envisaged that the subject will introduce GET learners to the basics of Civil Technology, Electrical Technology, Mechanical Technology and Engineering Graphics and Design (DBE, 2011a:8). In addition, the DBE (2011a:8) declares that Technology education was introduced into the South African school curriculum “in recognition of the need to produce engineers, technicians and artisans needed in modern society...”

The GET Phase subject known as **Technology** gets more sophisticated in the FET Phase where four subjects can be distinguished: Civil Technology, Electrical Technology, Mechanical Technology and Engineering Graphics and Design.

¹ The *selection of subjects* as reflected in the title implies *subject choice*.

Civil Technology centres on three main areas: civil services, construction and woodworking. The subject introduces learners to the concepts and principles in the built environment and on the technological process. Civil technology prepares learners to enter into learnerships or apprenticeships that will prepare them for a trade test (DBE, 2011d:8, 9).

Electrical Technology focuses on the understanding and application of electrical and electronic principles of three main areas: electrical, electronics and digital systems. After Grade 12, learners could enter the world of work as apprentices, enter into learnerships or continue into National Certificate Vocational (NCV) courses (DBE, 2011e:8, 9).

Mechanical Technology is in essence applied science. To be able to take this subject, learners should be interested in any form of mechanical entities and if possible, should also include subjects such as Mathematics, Physical Science or Engineering Graphics and Design in their curriculum (DBE, 2011f:8).

Engineering Graphics and Design introduces learners to the basic knowledge and various drawing techniques and skills which will enable them to interpret and produce drawings within the context of the field of Technology (DBE, 2011g:8).

1.4.2 Subject choice

South African learners select their subjects for the FET Phase in Grade 9. In order to qualify for the National Senior Certificate at the end of Grade 12, learners have to include four compulsory subjects in their curriculum. These subjects are two official languages, Mathematical Literacy or Mathematics and Life Orientation. In addition, learners should select a minimum of three subjects from an approved list of subjects (DBE, 2011h:19). In terms of the organising fields of learning of the National Qualifications Framework (NQF), subjects such as Civil Technology, Electrical Technology, Mechanical Technology and Engineering Graphics and Design are clustered under the organising field: Manufacturing, Engineering and Technology (DBE, 2011h:30, 36).

1.5 RESEARCH METHODOLOGY

1.5.1 Research paradigm

According to Nieuwenhuis (2012a:48) a paradigm serves as a lens or organising principle by which reality is interpreted. Applicable to research, De Vos and Strydom (2012:41) assert that all scientific research is conducted within a specific paradigm since it provides for a viewpoint from which researchers can view their research material.

In the case of the intended research, the researcher wants to uncover and understand the determinants that affect Grade 9 learners' selection of subjects in the field of Technology for the FET Phase in the Sedibeng area. This implies, according to Creswell (2009:10) that "pluralistic approaches" will be required to generate sufficient knowledge to illuminate the problem from various perspectives and to arrive at valid conclusions. Based on the aforementioned argument, the researcher is convinced that the intended research is founded on **pragmatism** since the success of the research is dependent on what works – in this case, a mixed methods research design (Creswell, 2009:10; McMillan & Schumacher, 2010:6).

1.5.2 Research design

Both a literature study and an empirical investigation were conducted.

1.5.2.1 Literature study

Local and international primary and secondary sources such as books, journals, dissertations and theses, conference papers and official documents were consulted in order to gather information to address the aim of the research. In addition, a variety of electronic databases, which include NEXUS, PSYCINFO, EBSCO-Host, ERIC and SABINET, as well as internet websites, were utilized to obtain relevant and most recent literature.

Amongst others, the following key words were identified and used to search for literature: **Technology, Technology education, Technology as field of study, Civil Technology, Electrical Technology, Mechanical Technology, Engineering Graphics and Design, learner subject choice.**

1.5.2.2 Empirical study

The empirical study as outlined below covers the empirical research design, the strategy of inquiry, the population and sampling, data collection methods, quality criteria, the role of the researcher, ethical considerations and the data collection process.

1.5.2.2.1 Empirical research design

A research design is “a set of procedures that researchers use to collect, analyse, and report their data in a research study” (Plano Clark & Creswell, 2010:166). Based on the assumption that “collecting diverse types of data best provides an understanding of a research problem” (Creswell, 2009:18), the empirical part of the intended study was conducted by using a **mixed methods** research design. Ivankova, Creswell and Plano Clark (2012:269) describe mixed methods research as “a procedure for collecting, analysing and “mixing” both quantitative and qualitative data at some stage of the research process ... to understand a research problem more completely”. Ivankova et al. (2012:272-276) distinguish between a variety of mixed methods research designs such as the explanatory, exploratory, triangulation and embedded mixed methods designs. In this study an **explanatory mixed methods design** (Ivankova et al., 2012:272), was employed since both quantitative and qualitative data, which were collected in different phases of the study, were used. To illuminate the research problem qualitative findings were used “to help clarify ... refine, explain and extend” (Ivankova et al., 2012:272) the quantitative results. According to Creswell (2009:211) the two forms of data (quantitative and qualitative) are separate but connected although weight is given to the quantitative data. For the purpose of this study, quantitative data were collected from Grade 9 Technology teachers and their learners. This was supplemented by the collection of qualitative data from subject facilitators in the field of Technology. By collecting data from diverse research participants using a mix of quantitative and qualitative approaches, the researcher anticipated rich information that would contribute towards the findings of the research. Although the two data sets were collected and analysed independently from each other, they were used complementarily to arrive at the final interpretation of the research results (Creswell & Plano Clark, 2011:70, 71).

1.5.2.2.2 Strategies of inquiry

Creswell (2009:11) defines strategies of inquiry as “types of qualitative, quantitative, and mixed methods designs or models that provide specific direction for procedures in a research design”. Since it was the researcher’s intention to uncover and understand the problem of the study from both a quantitative and qualitative perspective, these approaches were applied in a sequential manner. The specific type of mixed methods design could thus be further clarified as being a **sequential explanatory mixed methods strategy**. To illuminate the problem of the study from a quantitative perspective, a non-experimental, **survey** strategy of inquiry was followed. According to McMillan and Schumacher (2010:22-23), surveys are used to describe attitudes, beliefs and opinions and allows “that information about a large number of people can be inferred from the responses obtained from a sample”. This study intended to gather the opinions of a sample of Grade 9 Technology teachers and their learners which would enable the researcher to uncover and understand the determinants that affect Grade 9 learners’ selection of subjects in the field of Technology for the FET Phase in the Sedibeng area.

To gather information from a qualitative perspective, the researcher embarked on a **phenomenological** study (Fouché & Schurink, 2012:316-318). A phenomenological study is usually applied to facilitate a researcher’s understanding and description of a specific issue based on the lived experiences of selected individuals (Fouché & Schurink, 2012:316). In the intended research, interaction with Technology subject facilitators about their experiences regarding certain matters related to Technology education enabled the researcher to better understand the determinants that affect Grade 9 learners’ selection of subjects in the field of Technology for the FET Phase in the Sedibeng area.

1.5.2.2.3 Research population and sample

Welman and Kruger (1999:18) state that a population includes the whole group of cases that the researcher needs to probe for his research. However, for logistical and financial reasons it was not possible to include all teachers, learners and subject facilitators involved in Grade 9 Technology in South Africa in this study. Therefore, the study population was confined to the Sedibeng East (D7) and Sedibeng West (D8) districts. In these two districts there are seventeen (17) secondary public

schools, (ex-Model C schools as well as Township schools), which offer FET subjects in the field of Technology. Based on the rationale of non-probability, purposive sampling (Strydom, 2012:232), all 17 these schools were included in the study since all of them afford learners the opportunity to continue their school careers by selecting subjects in the field of Technology.

Subsequently, it was envisaged that all teachers (n=34) teaching Grade 9 Technology in the 17 schools would be selected purposively for the quantitative part of the study since they exhibited the characteristics required for the purpose of the study. Regrettably, due to the said teachers' reluctance to participate in the research, the researcher managed to include only ten (10) teachers in the sample. Continuing the sampling for the quantitative part of the study, Grade 9 learners of the selected 17 schools were sampled by means of systematic random sampling (Strydom, 2012:230), using class lists and intervals of every tenth learner. By following the guidelines provided by Leedy and Ormrod (2005:207) as well as McMillan and Schumacher (2010:141), the size of the learner sample was estimated at three hundred (300) which represented at least ten per cent (10%) of the Grade 9 learners in the sampled schools. However, due to the number of learners per school, 388 learners eventually were included in the sample to participate in the research.

Purposive participant selection was used to select the Technology subject facilitators for the qualitative part of the study. During the time of the research the number of these facilitators in the two districts added to eight (8). However, only three of the facilitators were readily available to participate in the research.

1.5.2.2.4 Data collection methods

Quantitative data were collected from the sampled teachers and learners by means of self-developed questionnaires which were informed by the literature study and the researcher's encounters with learners' subject choices in the field of Technology. The questionnaires comprised of close-ended questions and included biographical, dichotomous, multiple-choice, ranking and four point Likert scale items (Maree & Pietersen, 2012:161-168). The researcher attempted to ensure compatibility between items of the teacher and learner questionnaires, since this would have

helped in identifying and reporting convergent and divergent data. The completion time for the questionnaires was estimated at 20 minutes.

Since the qualitative data were intended to be used for enlightenment purposes, one-to-one interviews (Greeff, 2012:347) were conducted with the sampled Technology subject facilitators. For the purpose mentioned, an interview guide, which included items related to the questionnaires, was developed. The interview guide also helped to maintain the questioning order and the consistent phrasing of questions. The interview was semi-structured in nature “to define the line of inquiry” and to allow for “the probing and clarification of answers” (Nieuwenhuis, 2012b:87). Interview sessions were scheduled for 30 minutes each.

1.5.2.2.5 Data collection process

Anticipated as a triangulation mixed methods study, the research was executed by following quantitative and qualitative approaches. The following steps were followed to collect data:

- Permission was obtained from the Gauteng Department of Basic Education to conduct the study (**Appendix A**).
- Permission was obtained from the Ethics Committee of the North-West University, Vaal Campus to continue with the study (**Appendix B**).
- School principals of the sampled schools, as well as the sampled teachers and Technology subject facilitators were approached to get their consent to participate in the study (**Appendices C, D & E**). Since the sampled Grade 9 learners were regarded as minors, their parents were also required to give their assent that their children may form part of the study (**Appendix F**).
- After conducting a pilot study, the study commenced by disseminating, administering and gathering the quantitative questionnaires to be completed by the sampled teachers (**Appendix G**) and learners (**Appendix H**).
- The qualitative part of the study followed by conducting the one-to-one, semi-structured interviews with the sampled Technology subject facilitators (**Appendix I**) at a pre-arranged convenient time.

1.5.2.2.6 The role of the researcher

The researcher was aware that his position as teacher education lecturer in the field of Technology at the North-West University may impact on the research results. Therefore he was obliged to eliminate factors such as “biases, values and personal background” (Creswell, 2009:177) that may impact on the research or shape his interpretations during this study. As a consequence, the researcher conformed to “a range of strategic, ethical, and personal issues” (Creswell, 2009:177). These issues related, inter alia, to the researcher’s alertness to administer the questionnaires and interviews with caution and by ensuring relaxed circumstances in which this could take place. Furthermore, the researcher was receptive to protect the rights and welfare of all the research participants and dealt with this in an ethically responsible manner.

In accordance with the suggestions of Creswell (2009:177) and Maree and van der Westhuizen (2012:41) concerning the role of the researcher, the researcher:

- obtained permission from relevant structures and individuals to conduct the research,
- compiled and administered the questionnaires,
- compiled, administered and conducted the interviews, and
- analysed and interpreted the data.

1.5.2.2.7 Data analysis and interpretation

The Statistical Consultation Services of the North-West University, Vaal Triangle Campus were consulted to assist with the analysis of the quantitative data. The responses to the questionnaires were analysed by applying descriptive and inferential statistics. According to Leedy and Ormrod (2005:30) as well as Jansen (2012:19), descriptive statistics are used to summarize the general nature of research data. Frequency counts and percentages were calculated by comparing differences and similarities in the results obtained from the sampled respondents. By using inferential statistics such as a factor analysis the researcher was able “to make decisions” (Leedy & Ormrod, 2005:30) about the data or to draw statistically valid inferences from the data (McMillan & Schumacher, 2006:150). In addition, some of the quantitative data were represented visually in order to identify graphical patterns in the gathered information.

The purpose of the qualitative part of the study was to obtain a deeper understanding of the researched phenomenon through interviews. Interview questions thus replicated some of the items of the questionnaires. These questions served as pre-set categories into which coded data were categorised (Nieuwenhuis, 2012c:109) since they represented key factors which may impact on learners' subject choice. The analysis of the qualitative data was thus done by using *a priori* coding (Nieuwenhuis, 2012c:107) and by following a process of *constant comparison* (McMillan & Schumacher, 2010:377) to ensure that the transcribed raw interview material and applicable codes were assigned to relevant categories.

1.5.2.2.8 Quality criteria

Triangulation which allows the researcher to have confidence in the research results and which enhances the transferability of the study's results (De Vos, 2005:361) was used. For the purpose of this study, methodological and data triangulation were ensured. Methodological triangulation (De Vos, 2005:362) was done by applying both quantitative and qualitative approaches to reinforce each other within a mixed methods research design. Data triangulation (De Vos, 2005:362) was incorporated in the form of different data collection instruments such as questionnaires and interviews. These multiple data sources also assured **external validity** or the extent to which the conclusions drawn from the research can be generalized to other contexts (Leedy & Ormrod, 2005:99; McMillan & Schumacher, 2010:265). **Internal validity** of the instruments was determined by checking that all questions, whether part of the questionnaires or interview, are related to the focus of the research; therefore face and content validity (Pietersen & Maree, 2012:217) were applied. **Reliability** measures (Pietersen & Maree, 2012:215) included the examination of items in the data collection instruments to ensure that they were carefully worded so that their intended meanings were clear to all participants; that possible leading questions, which could influence participants to respond in a particular way, were eliminated, and by removing double-barrelled questions where the same question has many parts. The Cronbach Alpha reliability co-efficient was also applied to ensure the reliability of selected questionnaire items. Prior to the research, a pilot study was conducted with a small group of participants, reflecting sameness to the actual research participants. The pilot study was done to audit the research instruments for reliability and validity.

To guarantee the trustworthiness of the qualitative part of the study, **credibility** (Schurink, Fouché & De Vos, 2012:346) was ensured by orally recording the responses of the research participants on audio-tape during the interviews. **Dependability** (Schurink, Fouché & De Vos, 2012:420) was ensured by examining the documentation, such as the interview notes and interpretations made by the researcher to secure accuracy in terms of changing conditions. For **conformability** (Schurink, Fouché & De Vos, 2012:421) or for ensuring unbiased findings, the researcher based all interpretations solely on the raw data gathered from the recorded audio-tapes and requested a peer reviewer to verify the verbatim transcripts with the findings.

1.5.2.2.9 Ethical aspects

By following the ethical guidelines as indicated by Leedy and Ormrod (2005:102) and Creswell (2009:92), the following was done:

- A prescribed research request from the Gauteng Department of Basic Education was completed and submitted to the Department for approval to administer the research.
- An application of approval to conduct the research was submitted to the Ethical committee of the North-West University, Vaal Campus.
- Once the research was approved, school principals, teachers, learners and their parents, as well as Technology subject facilitators were consulted to obtain permission to participate in the research.
- Participants were provided with a description of the nature of the research, what their participation will involve as well as a statement which indicated that their participation is anonymous and voluntary and that their responses will be treated confidentially and only used for research purposes.
- All the research participants signed an informed consent/assent form before the research commenced.
- Completion of questionnaires and participation in interviews were done without interfering with teaching and learning activities.
- The research was based on sound data and findings, obtained from the actual empirical study and the researcher avoided at all costs the falsifying or invention of findings, as this is regarded as scientific misconduct.

1.6 POSSIBLE DELIMITATIONS OF THE STUDY

A major delimitation of the intended study was that it was confined to only two districts in the Gauteng province of the Department of Basic Education. However, the research potentially served as a thrust for similar research in other districts or provinces which could also be related to Grade 9 learners' choice of other subjects for the FET Phase. The potential limitation in the generalizability of the research results was thus observed very carefully when reporting data.

1.7 SIGNIFICANCE AND POSSIBLE CONTRIBUTION OF THE STUDY

The significance of this study is based on the fact that it intended to provide an appraisal of the determinants affecting Grade 9 learners' selection of subjects in the field of Technology for the FET Phase. Through the obtained data, the researcher was able to identify the weaknesses and strengths in the field of Technology education which, as a consequence, could help to improve the quality of teaching and learning as well as the status of subjects in this knowledge field. In addition, the aforementioned aspects could also lead to more learners choosing subjects in this field. In terms of possible long term outcomes, it was envisaged that the research could be informative to all stakeholders in the field of Technology education to address the technical skills, shortages and demands of society.

1.8 POSSIBLE CHALLENGES OF THE STUDY

Potential challenges were the availability and willingness of respondents to complete the questionnaires and to participate in the interviews open-mindedly in an objective and honest manner. The researcher attempted to deal with such challenges by explaining the purpose and importance of the research and by personally administering the data collection process. Adhering to the required ethical standards also assisted in this regard.

1.9 PROVISIONAL CHAPTER DIVISION

The study unfolded as follows:

Chapter 1: Orientation, description of the problem and purpose of the study, overview of the research methodology, theoretical framework and the research outlay.

Chapter 2: Literature review: Technology education in the South African context and factors impacting on subject choice.

Chapter 3: Overview of the empirical research: description of the research paradigm, design, sample, data collection methods, quality criteria, data collection process and ethical considerations.

Chapter 4: Data analysis and interpretation.

Chapter 5: Findings, conclusions and recommendations.

1.10 CONCLUSION

This chapter introduced and motivated the study. The problem, purpose, research questions and objectives of the study were outlined and an overview of the conceptual framework and research methodology was provided. Delimitations of the study, its significance and possible contribution as well as possible anticipated challenges were also presented. The chapter was concluded by delineating the structure of the study.

The following chapter will draw on the literature to discuss Technology education in the South African context and factors impacting on subject choice.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

The researcher's interest centres on the possible factors that impact on Grade 9 learners' decision to include or exclude subjects in the field of Technology in their curriculum for the Further Education and Training (FET) phase. Consequently, the purpose of the study is to appraise the determinants affecting Grade 9 learners' selection of Technology subjects for the FET phase.

In this chapter the researcher will report on the investigation of relevant literature to answer the following secondary research questions:

- What is the rationale for, and value of Technology Education as part of the South African school curriculum?
- What is the nature of Technology subjects in the South African school curriculum?
- What influences learners' subject choices?

To enable the researcher to satisfactorily address the abovementioned questions, the way in which Technology education is defined will be investigated. This will be followed by considering the introduction of Technology education in the South African school curriculum by also looking at the rationale and aims behind its introduction. Thereafter, infusion of Technology education in the South African school curriculum will be contemplated by explaining the nature of Technology as subject in the Senior phase and the nature of Technology as field of study in the FET phase. Subsequently, possible factors impacting on learners' subject choices will be considered after which recent developments regarding the choice of subjects in the Technical field of study within the South African school system will be highlighted.

2.2 THE RATIONALE AND VALUE OF TECHNOLOGY EDUCATION

2.2.1 Defining Technology education

In order to appreciate the rationale and value of Technology education, it is necessary to consider how Technology and Technology education are defined. A basic definition of Technology reveals that it is a study of changes made by man in

the forming of materials to increase their value (Bonser & Mossman, 1923:5). According to Hodgkin (1990:208) the term “Technology” is derived from the Greek words *tekhne* (Ancient Greek) or *techne* (modern Greek) which means the explanation of theory related to the art and craft or the making of things and the term *logia*, meaning an area of study. Thus, according to Hodgkin (1990:208) Technology means “the study of the science of crafting”. In the discussion document: A Curriculum Model for Education in South Africa (CUMSA) (November, 1991) which formed part of the Education Renewal Strategy (ERS, 1992), Technology is defined as “humankind’s purposeful mastering and creative use of knowledge and skills with regard to products, processes and approaches so as to better manage his environment” (Ankiewicz, 1993:124). Combining the aforementioned views, the International Technology Education Association (ITEA) (2001:1) suggests that broadly speaking, Technology is associated with “how people modify the natural world to suit their own purposes”. In addition, it is indicated that Technology literally means “the act of making or crafting, but more generally it refers to the diverse collection of processes and knowledge that people use to extend human abilities and to satisfy human needs and wants” (ITEA, 2001:1). Volti (2014:6) asserts that Technology is “a system that uses knowledge and organization to produce objects and techniques for the attainment of specific goals”. In another attempt to define the concept, the Oxford Dictionary (2015) identifies at least three constituents of Technology:

- the application of scientific knowledge for practical purposes, especially in industry;
- machinery and devices developed from scientific knowledge;
- the branch of knowledge dealing with engineering or applied science.

Within the education context, it appears as if Technology is defined in more particularized terms. One of the first definitions of Technology which incorporates education is that of Wilber (1948:2) who states that Technology education comprises “those phases of general education which deal with industry - its organisation, materials, occupations and products - and with the problems of life resulting from the industrial and technological nature of society”. Snyder and Hales (1981:1) define Industrial arts (the American version of Technology education), as a comprehensive, action-based educational programme concerned with the technical means, their

evolution, utilisation and significance within industry; its organisation, personal systems, techniques, resources and products and socio-cultural impact. The British equivalent of Technology education, Design and Technology, is a well-established subject in the primary and secondary school curriculum (Benson, 2009:23). It is defined as “an inspiring, rigorous and practical subject” in which learners are expected to use their creativity and imagination to “design and make products that solve real and relevant problems within a variety of contexts, considering their own and others’ needs, wants and values” (DoE England, 2013). Within the South African context, Technology education is defined as “the use of knowledge, skills and resources to meet people’s needs and wants by developing practical solutions to problems while considering social and environmental factors” (DBE, 2002:28; DBE, 2011a:8).

For the purpose of this study the definition of the South African Department of Basic Education (DBE, 2002:28; DBE, 2011a:8) will be used.

2.2.2 The introduction of Technology education in the South African school curriculum

2.2.2.1 Background

Conducting research into employer expectations of South African school-leavers, the main finding of the Walters Committee on “The evaluation and promotion of career education” (1990) reveals that matriculated school-leavers did not, in general, live up to employer expectations (Kraak, 2002:5). The most serious shortcomings mentioned by employers were school-leavers’ lack of appropriate work attitudes, thinking skills and productivity awareness (Kraak, 2005:6). As a result, the Walters Committee recommended significant changes to the South African school curriculum. It specifically recommended that subjects such as Home Economics (Hand- and Needlework, Textiles, Cooking, Nutrition), Basic Techniques, Technical Orientation and the Handwork subjects also known as Industrial Arts (Woodworking, Metalworking, Electrical and Motor Mechanics) (Engelbrecht, 2007:1), be re-curriculated in their entirety with reference to the England’s “Craft Design and Technology” approach, by also taking the South African context and needs into account. The implication was that where boys and girls were separated when doing Home Economics (girls) and Basic Techniques (boys) in the pre-1998 curriculum, it

was now suggested that they should be put together in one class to be taught the same theory and skills in the subject called Technology.

In May 1990, the then Minister of National Education announced the development of an Educational Renewal Strategy (ERS) for South Africa. This strategy was to be developed in conjunction with the Ministers responsible for education and was to be carried out under the auspices of the Committee of Heads of Education Departments (CHED) (ERS, 1991:6). The Education Renewal Strategy (1991) made similar proposals to the Walters Committee, and also recommended the introduction of a number of new compulsory subjects into the general, formative curriculum (Gr.1-9). Included amongst these compulsory subjects, were Economics, Technology and Arts Education. The rationale for including these three subjects into the curriculum was that they would provide education relevant to the needs of learners and society; that they would create continuity starting from the lower grades, as the subjects Economics and Arts Education only formed part of the Grade 10 to 12 (Standards 8 to 10) curriculum, and that they would contribute towards the workforce requirements of South Africa (Stevens, 2005:2).

As a result of the ERS and CUMSA proposals, a National Task Team was appointed early in 1994 to spearhead the introduction of Technology education into the South African school curriculum. Under the project, entitled 'Technology 2005' (T2005), the National Task Team developed a national Technology curriculum. Trailing of this curriculum in all nine provinces took place between March 1994 and March 1997 (Gr.1-9) (Stevens, 2005:5). With the introduction of the first new school curriculum in the democratic South African, Curriculum 2005 (C2005), unrealistic time frames set by the National Department of Education placed such strains on the education system that the newly introduced subject, Technology, lost some of its novelty opportunity (Stevens, 2005:5). At that time there were no formally trained Technology teachers, no text books and no material resources (Gumbo, 2013:7).

2.2.2.2 The rationale behind the introduction of Technology education in the South African school curriculum

According to Potgieter (1998:7), the rationale for the introduction of Technology education in the South African curriculum seeks to develop learners':

- understanding of technological knowledge, skills and attitudes;

- capacity and desire to be engaged in technological process, and
- understanding of the impact of technology on the individual, family, community, commerce, industry and the nation as a whole.

Lewis (2005) (cited by Gumbo, 2013:1) asserts that the main reason for introducing Technology education in the South African national school curriculum is two folded. Firstly, it recognizes the need to produce engineers, technicians and artisans needed in the modern society, and secondly it is a reaction to the need to develop a technologically literate society for the modern world (Lewis, 2005).

Further justifying the introduction of Technology education in the curriculum, it is also contended that the subject stimulates learners to be innovative and develops their creative and critical thinking skills (DBE, 2011a:8). Moreover, Technology education provides a solid foundation for several Further Education and Training (FET) subjects as well as for the world of work by teaching learners to manage time and material resources effectively, and providing opportunities for collaborative learning and teamwork (DBE, 2011a:8).

2.2.2.3 The aims of Technology education

Technology education, as stipulated in the CAPS (DBE, 2011a:8), contributes towards learners' technological literacy by giving them opportunities to:

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

The above aims suggest that Technology education should equip learners with technological and environmental knowledge to enable them to apply it in new and different contexts. One of the main tasks of Technology education is to allow learners to construct a framework of knowledge to help them to make connections between ideas and concepts. This implies that Technology concepts learnt at school should empower learners to understand that technology can be relevant to their lives outside the school environment; for example, growing food without damaging the land. Thus, learners should not only be able to understand the practical uses of

technology in society and the environment, but should also be able to demonstrate values reflecting characteristics of caring and creative citizens.

It is further stated that Technology education in the Senior phase of the curriculum, should allow learners to acquire the basics needed in Civil Technology, Mechanical Technology, Electrical Technology and Engineering Graphics and Design applicable to the Further Education and Training phase (FET phase) (DBE, 2011a:8). In addition, learners should gain an idea of the ways in which the engineering field apply scientific principles to practical problems, while the skills of product design and production and evaluation are also fostered (DBE, 2011a:8). In conclusion, the CAPS state that Technology education aims to provide learners with some experience to help them to make career oriented subject choices at the end of Grade 9 (DBE, 2011a:9)

2.3 THE INFUSION OF TECHNOLOGY EDUCATION IN THE SOUTH AFRICAN SCHOOL CURRICULUM

2.3.1 Background

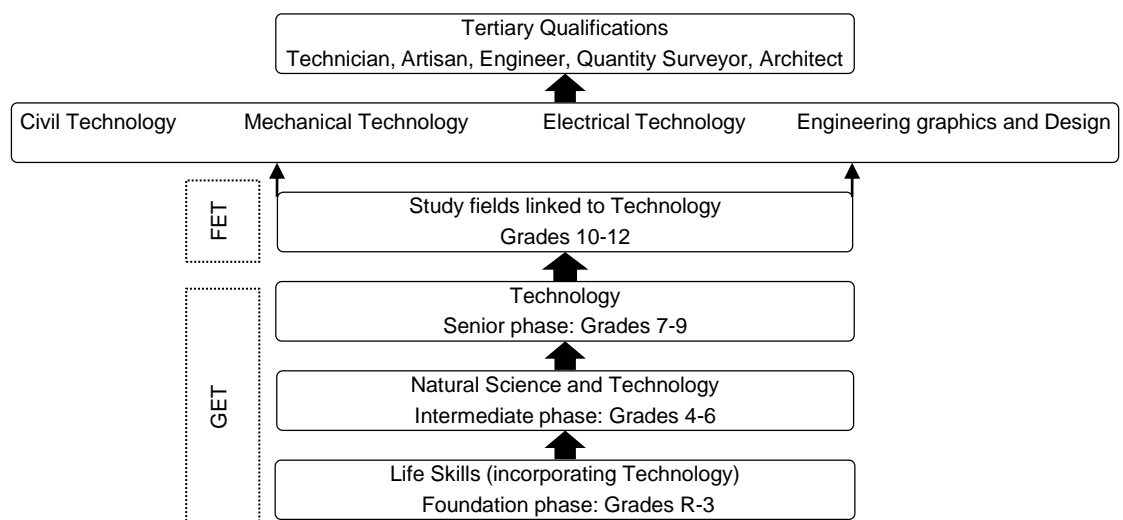
According to the previous curriculum discussion document (Curriculum 2005) (C2005) (DoE, 1997:7), the South African school system is divided into two bands. The first is the General Education and Training band (GET band). This band caters for compulsory education and includes the Foundation phase which accommodates learners from Grades R - 3 (age group: 6 - 9), the Intermediate phase which ranges from Grades 4 - 6 (age group: 10 - 12) and the senior phase which includes Grades 7 - 9 (age group: 13 - 15). The second band is the Further Education and Training band (FET band). This is a non-compulsory educational band that consists of Grades 10 - 12 (age group: 16 - 18) (DoE, 1997:9).

In the post-1994 curricula, Curriculum 2005 (C2005) as well as in the Revised National Curriculum Statement (RNCS), Technology was referred to as a Learning Area. The latter was defined as “a field of knowledge, skills and values which has unique features as well as connections with other fields of knowledge and Learning Areas” (DoE, 2002:9). Hence, Technology was an unique entity and part of all three phases in the GET band as a non-elective. In the Curriculum and Assessment Policy Statement (CAPS) (DBE, 2011:8), the designation “Learning Area” changed to

“subject” after 2011 and in this curriculum, the single entity status of Technology was largely abolished. In the Foundation phase Technology was incorporated into the subject Life Skills and in the Intermediate phase it was combined with the Natural Sciences to form the subject Natural Sciences and Technology (DBE, 2011:8). The main reasons for assimilating subjects was the overwhelming progression from four subjects in the Foundation phase to eight subjects in the Intermediate phase and to reduce the workload of teachers (Curriculum News, May 2010:3). However, Technology remained a single subject entity in the Senior Phase (Grade 7-9).

In the FET Phase (Grades 10 - 12) Technology is grouped with Manufacturing and Engineering as an organized field of learning. Within this field, Technology is an elective subject that provides a choice of specialization in fields of study such as Civil Technology, Mechanical Technology, Electrical Technology and Engineering Graphics and Design. Figure 2.1 below illustrates the infusion of the subject Technology in the respective phases.

Figure 2.1: Technology education in the South African school curriculum

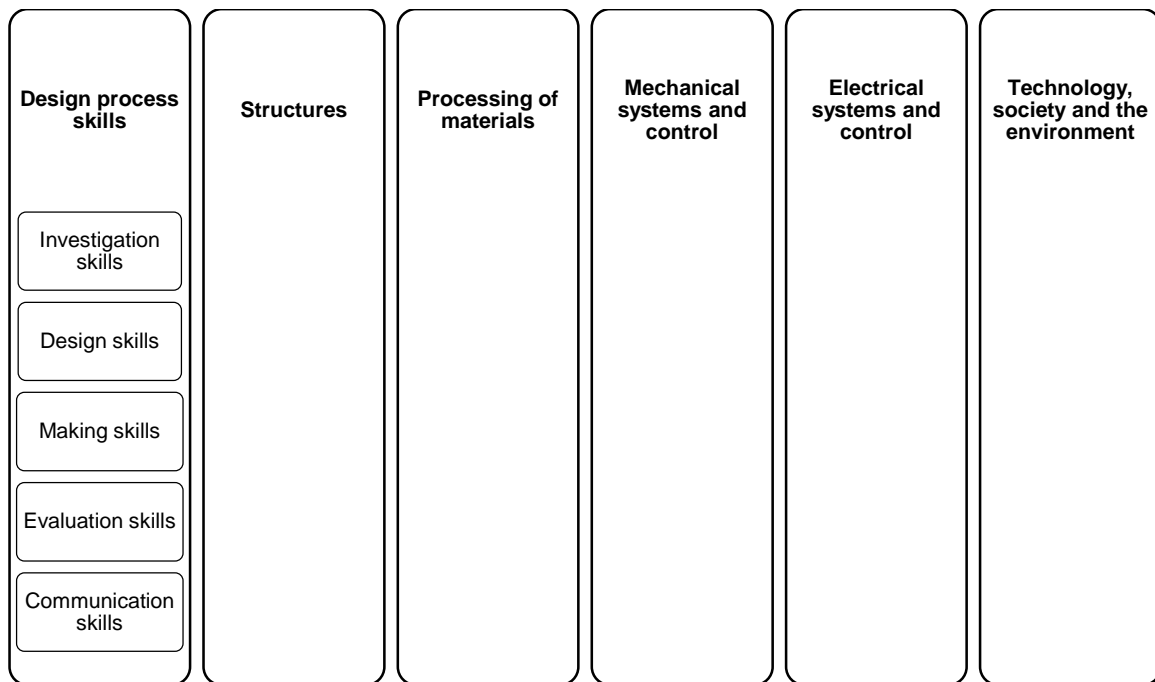


2.3.2 Technology as subject in the Senior phase: Grades 7 - 9

Since Technology is incorporated into other subjects in the Foundation and Intermediate phases, together with the fact that this study is concerned with Grade 9 learners, the foci of Technology within the Senior and FET phases will be briefly entertained. In Figure 2.2 the main topics of the Senior phase Technology curriculum are reflected. These include: design process skills, structures, processing

of materials, mechanical systems and control, electrical systems and control and technology, society and the environment. Drawing extensively on the pioneering of Design and Technology of the United Kingdom and other commonwealth countries such as Australia and New Zealand, Technology was introduced in the GET band, using the design process as a key focus (Stevens, 2009:131).

Figure 2.2: Main topics and core content of Technology as subject in the Senior phase (Source: DBE, 2011a:10)



2.3.3 Technology as field of study in the FET phase: Grades 10 - 12

In the FET phase Technology as field of study is divided into four subjects: Engineering Graphics and Design, Civil Technology, Mechanical Technology and Electrical Technology. The purpose of this differentiation is to get the learners to be more focused on specialist areas in the Engineering field. As a result, Technology education in the FET phase could be defined as discipline specific Technology education and training with a view towards a specific range of jobs or employment possibilities for school leavers. An outline of each of the differentiated subjects follows below.

(i) Engineering Graphics and Design

Engineering Graphics and Design (EGD) teaches internationally acknowledged principles that have both academic and technical applications. The emphasis in EGD is on teaching specific basic knowledge and various drawing techniques and skills so that the EGD learners will be able to interpret and produce drawings within the contexts of Mechanical Technology, Civil Technology and Electrical Technology (DBE, 2011g:8). According to the CAPS (DBE, 2011g:10), learners enrolled in the subject Engineering Graphics and Design could opt for one of the following career opportunities:

- Architecture
- Most engineering fields (e.g. Civil, Mechanical, Aviation, Maritime, Agricultural, Mining)
- Medical technician
- Industrial designer
- Interior designer
- Landscape architect
- Quantity surveyor
- Building management
- City planner
- Land surveyor
- Teacher
- Graphic illustrator
- Jewellery designer
- Model builder (scale models)
- Draughtsperson (e.g. Steel structure, Architectural, Civil, Design, Electrical)
- Technicians
- Most manufacturers
- Most artisans
- CAD system operator

(ii) Civil Technology

Civil Technology focuses on concepts and principles in the built environment and on the technological process. It embraces practical skills and the application of

scientific principles. This subject aims to create and improve the built environment to enhance the quality of life of the individual and society and to ensure the sustainable use of the natural environment (DBE, 2011d:8, 9). The subject focuses on three main areas, namely:

- civil services;
- construction, and
- woodworking.

According to the CAPS (DBE, 2011d: 10), learners enrolled for the subject Civil Technology, will opt for one of the following career opportunities:

- Apprenticeship to become an artisan
- Continued studies at a college offering the National Curriculum Vocational (NC(V)) to follow a vocational career pathway
- Higher education at a University of Technology
- Higher education at an academic-oriented university (to study Engineering)
- Working as an entrepreneur or working with an entrepreneur
- Higher education to study technical education in order to become a teacher teaching Technology.

Career and life experience opportunities for learners with a foundation in Civil Technology (DBE, 2011d: 11), include those of:

- Carpenter and joiner
- Bricklayer
- Tiler
- Painter
- Plumber
- Drain layer
- Roof specialist
- Cabinet maker
- Shutter hand
- Building inspector
- Quantity surveyor
- Architect

- Draughtsman
- Building surveyor
- Building technician
- Civil engineer
- Structural engineer
- Civil Technology teacher.

(iii) Mechanical Technology

Mechanical Technology focuses on concepts and principles in the mechanical (motor, mining, shipping, rail, power generation, etc.) environment and on technological processes. It embraces practical skills and the application of scientific principles. This subject aims to create and improve the engineering and manufacturing environment to enhance the quality of life of the individual and society and to ensure the sustainable use of the natural environment (DBE, 2011f:8, 9). Although Mechanical Technology does not have the distinction of being a Grade 12 exemption subject for university entrance, it has the advantage of providing learners with the background of what is expected from them when enrolling for any mechanical study opportunity. A list of possible career opportunities for learners enrolled in the subject Mechanical Technology includes the following (DBE, 2011f:10):

- Apprenticeship as a motor mechanic, fitter and turner, welder, boiler maker, tractor mechanic, etc.
- Engineering studies in the fields of aviation, air-conditioning, motor cars, engines, ship building, power systems, electrical power stations, etc.
- Studies at Universities of Technology in various mechanical streams.
- Entering the world of work as an entrepreneur in various fields such as precision machining, programming of lathes and milling machines, fitment of accessories to cars and trucks to enhance performance and maintenance of many different mechanical installations.
- Research and development of new and current entities in the mechanical field of work.

(iv) Electrical Technology

Electrical Technology focuses on the understanding and application of electrical and electronic principles (DBE, 2011e:8, 9). The subject focuses on the following three main areas of specialization:

- Electrical
- Electronics
- Digital Systems

Electrical Technology unlocks a world of potential opportunities to any learner taking the subject. Owing to the nature of Electrical Technology, it is easy and relatively cheap to setup and operate an electrical/electronic/digital workshop at home for the purpose of starting a business or to practise a hobby for personal gain. Learners that opt for careers not related to the subject will have the advantage that they will gather sufficient knowledge and skills at the end of Grade 12 to continue experimenting for the purpose of self-tuition and the practice of electrical techniques.

Learners taking Electrical Technology could opt for one of the following study opportunities:

- Apprenticeship to become an artisan
- Study at a FET college in a vocational career pathway
- Enter higher education at a University of Technology or any academic-oriented University
- Enter the world of work as an entrepreneur or working with an entrepreneur
- Enter higher education to study technical education in order to become a Technical teacher.

Amongst others, career and life experience opportunities that exist for learners with a foundation in Electrical Technology, include (DBE, 2011d: 10):

- Electrical fitter
- Electrical or electronic engineer
- Electrical draughtsperson
- Electrical or electronic technician
- Electrical or electronic technologist
- Digital / software engineer

- Academic in the field of Electrical Technology
- Electronic mechanic
- Auto-electrician
- Electrician
- Radio technician
- Cell phone technician
- Communications technician
- PLC programming expert
- Electronics programming engineer
- Computer technician
- Robotics engineer
- Mechatronics technician
- Installation electrician
- Radio amateur
- Electronic hobbyist
- Radio control enthusiast
- Production manager

2.4 SUBJECT CHOICE

2.4.1 Background

Schools have an important part to play in developing the academic, technical and social skills of learners to enable them to play a meaningful part in social and economic life (DBE, 2013:26). Moreover, during their school careers learners are obliged to exercise crucial choices in preparation for their future roles. In this regard the South African school system allows learners to make subject choices at the end of Grade 9. These subject choices have a significant impact on the type of programmes learners would be able to apply for when considering higher education for further studies or to tie in with a prospective career field (FoodBev SETA, 2015). Decisions on subject choices also have wider economic implications for the country at large in that suitable subject choices could reduce the mismatch between skills acquired during formal education and those required in the workplace (Roberts, 2002; Smith, 2004). It is therefore imperative that learners exercise their subject choices with extreme care (NMMU, 2015). Currently, South Africa's schooling

system does not make provision for a large variety of subject choices. For most part, schools offer pre-packaged curricula, allowing learners to select subjects in the Science, Commerce or Humanities and Social Science fields of study. In some schools, subject choices are dependent on whether or not the school has teachers to teach particular subjects. In such cases, learners are compelled to take those subjects on offer or to find another school that offers the subjects in question. In addition, many schools designated to specifically offer vocational and technical subjects, offer only subjects that are academically oriented; thus limiting learners' subject and career choices. The effects of this state of affairs are far-reaching as school leavers may be deprived from being absorbed into the labour market due to inexperience, lack of marketable skills, and lack of exposure to the work environment (Southern African Global Distance Education Network Website, 2004).

In the following section, possible factors which may influence learners' subject choices will be discussed.

2.4.2 Possible factors impacting on learners' subject choice

2.4.2.1 Outline

In this section, the researcher will draw information from the literature in an attempt to identify factors which could possibly impact on learners' subject choices. The discussion will commence with Bronfenbrenner's Ecological Systems Theory (1977, 1979) to indicate how the interplay between different systems and factors within these systems could impact on subject choices. An overview of Woolnough's model of students' choice of Science and Engineering (1994) will also be provided to point out the identified factors in this model which most likely influence learners' choice of subjects, especially in the Science and Engineering fields (Woolnough, 1994:671). The discussion in this section will be concluded by providing a synopsis from the literature on factors influencing subject choice.

2.4.2.2 Bronfenbrenner's Ecological Systems Theory

Bronfenbrenner's model of Ecological Systems Theory (1977, 1979) embraces that human development is influenced by several environmental systems or different levels of systems within a particular social context. Bronfenbrenner's theory is also referred to as the Bio-ecological Systems Theory (Härkönen, 2007:16) and includes

four interacting dimensions, namely person factors, process factors, contexts and time. Person factors include personal attributes such as preferred ways of studying, while process factors refer to the forms or nature of interaction with the environment or within applicable contexts. Since human development takes place over time, the time factor considers changes within the person or the social contexts over a period of time. In addition, Bronfenbrenner (1977, 1979) delineates four types of nested systems in which human development transpires. These are referred to as *microsystems*, *mesosystems*, *exosystems* and *macrosystems*. These systems all interact with the *chronosystem*.

(i) Microsystems

According to Bronfenbrenner (1977, 1979) a person is constantly shaped, not only by the environment, but by any encounter with other individuals. It is in microsystems that the most direct interaction with social agents such as friends, family or teachers within an individual's neighbourhood, home or school takes place. These social agents within their respective contexts could have a multiple, simultaneous impact on the cognitive, social, emotional, moral and spiritual identity of an individual. In the context of this study, it is thus evident that microsystems such as families at home or teachers at school could influence learners' subject choices.

(ii) Mesosystems

Mesosystems represent the relations between different microsystems or the connections between contexts. These connections could be between family experiences and school experiences, or family experiences and peer experiences (Bronfenbrenner, 1977, 1979). Bronfenbrenner (1977, 1979) asserts that what happens in one microsystem can influence how an individual acts in another microsystem. Organisational or institutional factors such as rules and policies are part of mesosystems and can therefore affect learners' subject choices.

(iii) Exosystems

Exosystems are essentially any setting which affects the individual, although the individual is not required to be an active participant (Bronfenbrenner, 1977, 1979). Said differently: exosystems are concerned with the connection between a social setting in which the individual does not have an active role and the individual's

immediate context. For example, viewed from an exosystemic perspective, a parent's workplace or a peer group may influence how learners think about their subject choices.

(v) Macrosystem

Macrosystems are the cultural contexts (Bronfenbrenner, 1977, 1979) which involves dominant economic structures, values, beliefs and practices. For example: Capitalism as an ideology may impact on learners' subject choices since such choices could determine an individual's future economic status within a capitalist environment.

(vi) Chronosystem

Time affects the interactions between and the influences of the mentioned systems. Bronfenbrenner (1994:40) postulates that the chronosystem encompasses change or consistency over time in the individual and the broader environment in which the individual is involved.

2.4.2.3 Woolnough's model of students' choice of Science and Engineering

Woolnough's (1994:671) hypothesis that learners' choice of subjects, especially of those in the Science and Engineering fields, is influenced by four assumed factors: learners' ability and personality, learners' experiences in school, external inputs, and the value attached by society on Science and Engineering. Woolnough (1994:672) asserts that no single factor could be generalized as being responsible for learners' decisions to choose career paths as different learners are apparently persuaded by different factors. The reason behind this is that since learners differ in many ways, they also react differently to the same stimulus, which suggests the uniqueness of each individual. The four influential factors affecting learners' subject choices according to Woolnough (1994) are briefly outlined below.

(i) Learners' ability and personality

Woolnough's model (1994:664) reveals that there is a strong indication that potential career choices are made before the age of 16. These choices are, to a large degree, influenced by learners' perceived performance ability in particular subjects.

Obtaining consistently good performance results in a particular subject tends to influence learners to take the subject, anticipating further success.

(ii) Learners' experiences in school

The role of the teacher and the nature of the curriculum form prominent features of learners' experiences in school. Woolnough (1994) maintains that potential future scientists seemingly place greater value on the quality of science teaching and teacher encouragement as critical determinants for continued pursuit of science subjects and careers. In view of this, it is critical for teachers and subject departments, such as Technology, to set positive and credible precedents as this may influence learners' futures.

Adding to the above, Ainley (cited by Chimwayange, 2005:64) suggests that the type of school could also be considered as a significant determinant for subject choice. For example, an elite urban school and a poor rural school may be different in as far as resources and the quality in which the curriculum is presented are concerned. Learners' performance in, and consequently their choice of specific subjects may reflect disparities associated with different types of schools.

(iii) External inputs

External factors that may impact on the choice of a particular subject include a variety of elements. Amongst others, Woolnough (1994) cites the following: learners' background knowledge and experience of the subject, environmental exposure to the subject, acquaintance with the subject through significant role models, advice from parents as well as significant relatives, and scholarly inducements based on performance in the subject.

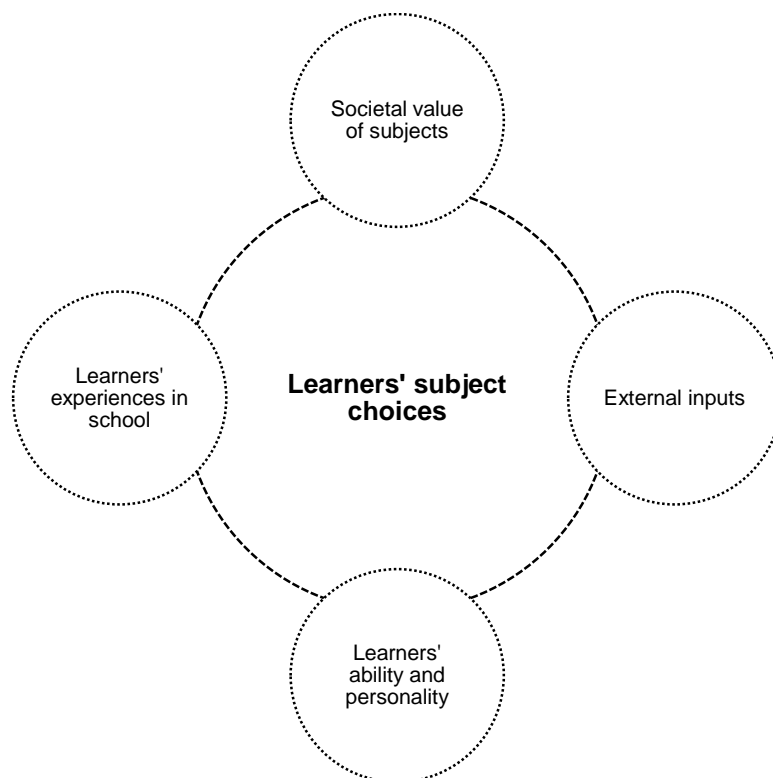
(iv) Societal value of the subject

In his model, Woolnough (1994) assumes that societal needs and demands act as pull factors. Learners' subject choices and career decisions are thus affected by personal factors, the school and external factors which are ultimately aimed at satisfying societal needs and demands. Woolnough (1994) argues that society attaches esteem and prestige value to some subjects and careers and this tends to attract learners anticipating higher social class attainment. Future career status,

salary and job satisfaction are also elements associated with the value society attaches to specific subjects and which may influence learners' subject choices.

In Figure 2.3 an adapted version of the four factors influencing learners' subject choice as proposed by Woolnough (1994) are visually presented. The dotted lines indicate the inter-dependence between the various factors.

Figure 2.3: An adapted version of Woolnough's (1994) model of subject choice



2.4.2.4 A synopsis from the literature on factors influencing subject choice

In addition to the identification of possible factors stemming from the work of Bronfenbrenner and Woolnough that may influence learners' subject choice, the literature was further examined to corroborate and elaborate on the already identified factors or to expand the list of factors.

2.4.2.4.1 *School type and location*

In a Kenyan study done by Kikechi et al. (2013:391), the type of school and whether the school is situated in an urban or rural environment, were identified as factors influencing the selection of technical subjects among secondary school learners.

2.4.2.4.2 Self-efficacy and personal interest in a subject

According to Bandura et al. (2001:187-206), self-efficacy is seen as people's judgement of their competence to organise and implement courses of action in order to achieve chosen levels of performance. People act in a certain manner because of anticipated results (Bandura et al. 2001). When people become convinced that they are self-efficacious, they act eagerly and confidently to obtain maximum results. This is particularly pertinent in the school situation, as it would mean that learners would become cooperative and actively involved when performing activities that they both enjoy and about which they are certain would yield positive results. This implies that learner's self-efficacy beliefs would not only influence their academic performances but also the subject choices they make (Pajares, 2002:2). In a study conducted by Kinyota (2013:58) learners' perceived self-efficacy through their examination performances is confirmed as an influential factor on subject choices. According to Adey and Biddulph (2001:443) learners' perception of a subject not only relates to their interest in such a subject, but could be seen as a powerful factor influencing subject choice. This is underscored by Azubuike (2011:55) who contends that learners' personal interest in a subject is a determining factor when making subject choices.

2.4.2.4.3 Influence of peers

According to Owoyele and Toyob (2008:586) learners' choice of subjects, especially at school level, is jointly influenced by peer pressure, parental will and academic ability. However, ordering these factors according to their importance appears to be problematic since they are apparently context dependent. To clarify: Owoyele and Toyob (2008:586) discovered that learners' choice of subjects is primarily influenced by peer pressure, followed by parental will and lastly by academic ability. In another study it is stated that peers have less influence than family members on learners' subject choices (Walaba & Kiboss, 2013:12). Nevertheless, it is generally assumed that peer influence cannot be ignored as an impacting factor on learners' subject choices.

2.4.2.4.4 *Influence of family*

According to Foskett and Hemsley-Brown (2001:1), human choices are the product of complex processes which generally takes place within the context of an individual's family since the family environment is mostly a consequence of its social situatedness. To clarify: the contrasts between choices made in so-called middle class contexts and working class contexts may reflect differences in the importance of economic and social factors in lifestyle models, differences in educational and social histories, and differences in the 'cultural capital' of individuals and families. Therefore, Adey and Biddulph (2001:448), Constantinou, Machailidis and Kyriakidou (2011:41), Shumba and Naong (2012:176) and Hashim and Embong (2015) conclude that parents, irrespective of the context from which they come, are influential when considering subject choices. Mohd, Salleh and Mustapha (2010:57) affirm this by stating that family members can provide information and guidance, whether intentional or unintentional to influence a young person's choices which are also applicable to subjects or careers.

2.4.2.4.5 *Influence of teachers*

In accordance with Adey and Biddulph (2001:448), Kiefer (2004:1) reports that learners choose certain subjects because their teachers make the subject interesting and put a lot of effort into the successful teaching of the subject. According to Mji and Makgato (2006:262), desirable teacher qualities which could also influence subject choices are good subject knowledge, innovative teaching skills, effective classroom management, sound relationships with learners, dedication and accessibility. This is also confirmed by Akerman (2012:58) who asserts that in addition to teacher expertise and knowledge, their passion for their subject is unquestionably one of the major reasons why learners choose particular subjects. In a study conducted by Adams and Salome (2014:1302) on factors affecting the choice of science subjects among female students in Nigeria, it is interesting to note that although teacher gender is an insignificant factor, competent and qualified teachers have a significant influence on the choice of science subjects. Hence, the importance of well trained, competent and passionate teachers should not be underestimated since such teachers, through their teaching and enthusiasm may arouse and sustain learners' interest in a particular subject. By considering the aforementioned, it is unfortunate that many teachers in South Africa are the victims

of their own education and teach in the manner in which they were taught (James, Naidoo & Benson, 2008:2); factors which may impact negatively on learners' subject choices.

2.4.2.4.6 Availability of resources

In a study by Gaotlhobogwe (2010:237) on the attitudes towards and perceptions of Design and Technology learners towards the subject in Botswana, the availability of resources was mentioned as an influential factor. This is underscored by Adams and Salome (2014:1302) who suggest that the availability of laboratory equipment / apparatus has an influence on the choice of Science as subject. It could thus be inferred that the availability of resources may impact on learners' subject choice.

2.4.2.4.7 Opportunities for further studies and future career paths

According to Edwards and Quinter (2011:86) opportunities for further studies and future career paths can be categorised as "outcome expectancies" or long term aims that influence learners' subject choice. Outcome expectancies is one of the main concerns of subject choices at school level since such choices impact on learners' selection of appropriate study programmes at higher education level and the career paths they want to follow. Therefore, career awareness is vital when individuals make subject choices because many Grade 9 learners might not be aware of the potential types of careers a particular subject prepares them for. If learners want to study further after school, they need to take the institutional requirements into consideration as well as what the subjects offer in terms of study programmes (SA Career focus, 2012:1).

2.5 A CONCISE OUTLINE OF SUBJECT CHOICES IN THE FIELD OF TECHNOLOGY

Although alluded to in 1.1, 1.4.2 and 2.3, the researcher thought it appropriate to concisely outline the most prominent guidelines pertaining to subject choices in the field of Technology within the FET phase of the South African school curriculum.

Based on the CAPS (DBE, 2011a:7), the current subject choices in the field of Technology that are available to learners in the FET phase (Grades 10-12) are represented in Table 2.1. According to this information all learners must offer all the subjects listed in column one of the table, except for Mathematics and Mathematical

Literacy where learners have to choose between these two subjects. In addition, provided that their school makes provision for the selection of subjects within the organising field of Manufacturing, Engineering and Technology, learners must offer Engineering Graphics and Design and include one other subject from the list of Civil Technology, Electrical Technology or Mechanical Technology. In cases where a school makes provision for any other organising field such as Science, Commerce or Humanities and Social Science, learners could choose Engineering Graphics and Design and any other subject offered by the school appropriate to the respective fields.

Table 2.1: Available subject choices in the field of Technology in the FET phase

Compulsory subjects for all learners	Subjects to be selected within the organising field of Manufacturing, Engineering and Technology		Subjects to be selected within any other organising field		
Home Language	Compulsory subject	Engineering Graphics and Design	Elective 1	Engineering Graphics and Design	
First Additional Language		Civil Technology	Elective 2	e.g. Physical Science	
Mathematics or Mathematical Literacy		Elective	Electrical Technology		
Life Orientation			Mechanical Technology		

It needs to be noted that the above guiding principles were effective at the time of the study, but that new guiding principles will be applicable as from January 2016. These new guiding principles differentiate between specialisation areas within Civil Technology, Electrical Technology or Mechanical Technology and make provision for Technical Mathematics and Technical Science in the organising field of Manufacturing, Engineering and Technology (Curriculum News, 2013:9, DBE, 2013:9).

2.6 CONCLUSION

This chapter addressed the applicable secondary research questions (*cf.* 2.1) by considering the rationale and value of Technology education (*cf.* 2.2), the infusion of Technology education in the South African school curriculum (*cf.* 2.3) and subject choices (*cf.* 2.4). In conclusion a concise outline of subject choices in the field of Technology was provided (*cf.* 2.5).

In the next chapter an overview of the empirical study will be given.

CHAPTER THREE

OVERVIEW OF THE EMPIRICAL STUDY

3.1 INTRODUCTION

The purpose of this chapter is to provide an overview of the research methodology applied in the empirical study. By considering the purpose of the study, the chapter aims to illuminate the research paradigm, the research design, the strategies of inquiry, the population and sampling, the data collection methods and the quality criteria applicable to the empirical study. The pilot study, role of the researcher and appropriate ethical considerations will also be discussed after which the chapter will be concluded by clarifying the research process.

3.2 THE PURPOSE OF THE STUDY

According to the Oxford English Dictionary Online, "*phenomena*" is described as something which appears, or something which is perceived or observed; thus implying a particular fact or occurrence, or change as perceived through the senses or known intellectually. Applicable to this study, the phenomena on which this research centres, is encapsulated in its purpose, namely the appraisal of determinants affecting Grade 9 learners' selection of subjects in the field of Technology for the FET Phase in the Sedibeng area. To enable the researcher to operationalize the stated purpose, the following objectives were formulated:

- To determine the rationale for, and value of Technology education as part of the South African school curriculum.
- To clarify the nature of Technology as field of study in the South African school curriculum.
- To establish the factors which influence learners' subject choices.
- To uncover the understanding and attitudes of Technology teachers teaching the subject in the GET Phase, regarding the subject.
- To ascertain the perceptions of learners in the GET Phase about the subject Technology.
- To discover the concerns of Technology subject facilitators regarding the viability and sustainability of Technology as field of study.

The first three of these objectives relate to the literature study and were addressed in chapter two. The remaining three objectives will be explored by means of the empirical framework as set out in the rest of this chapter.

3.3 RESEARCH PARADIGM

According to Hatch (2002:229), a paradigm represents a set of integrated and independent concepts and variables that is attached to related methodological approaches. Morgan (2007:49) adds to the aforementioned by indicating that a paradigm is a way for researchers to demonstrate the key content of their field, reflected as a set of shared beliefs about both the research questions as well as the methods that ought to be employed to answer these questions. Nieuwenhuis (2012a:48) asserts that a paradigm serves as a lens or organizing principle by which reality is interpreted, while De Vos and Strydom (2012:41) maintain that all scientific research is conducted within a specific paradigm since it provides for a viewpoint from which researchers can view their research material. McMillan and Schumacher (2014:13, 14) distinguish between the following paradigms: positivism, interpretivism or constructivism, the transformative and pragmatic paradigms.

In this study, the researcher wanted to uncover and review the determinants that affect Grade 9 learners' selection of subjects in the field of Technology for the FET phase in the Sedibeng area. Given the stated objectives which require an empirical investigation, the purpose of the study warranted "pluralistic approaches" (Creswell, 2009:10) to generate sufficient knowledge to illuminate the problem from various perspectives and to arrive at valid conclusions. Based on the aforementioned reasoning, the researcher contended that the intended research is founded on **pragmatism** since the success of the research is dependent on what works - in this case, a mixed methods research design (Creswell, 2009:10; McMillan & Schumacher, 2010:6). Research conducted within the pragmatist paradigm makes provision for the use of multiple research methods, different forms of data collection and different forms of data analysis to enable the researcher to understand the research problem better (Creswell, 2009:10). It is also suggested that pragmatism enables the researcher to anticipate the consequences of the research results (Creswell & Plano Clark, 2011:41). Made applicable to this study, data were not only collected and analysed by using different approaches, but determinates affecting

Grade 9 learners' selection of subjects in the field of Technology for the FET phase were identified and appraised by also considering the possible consequences of these determinants.

3.4 RESEARCH DESIGN

Leedy and Ormrod (2005:85) suggest that a research design provides the overall structure in which particular research will be conducted. According to Plano Clark and Creswell (2010:166), a research design represents “a set of procedures that researchers use to collect, analyse, and report their data in a research study”. Research designs can broadly be classified as quantitative, qualitative and mixed methods. Dawson (2006:15) suggests that quantitative research “generates statistics”. In contrast, qualitative research is aimed at the understanding of a research problem from the perspectives of research participants (Struwig & Stead, 2004:12). Derived from the research purpose, the researcher opted to perform the research within the pragmatic paradigm, since it was argued that diverse types of data would work best to gain an understanding of the research problem (Creswell, 2009:18). Consequently, it was decided to conduct the study by means of a **mixed methods** research design which can be described as “a procedure for collecting, analysing and “mixing” both quantitative and qualitative data at some stage of the research process in order to understand a research problem more completely” (Ivankova, Creswell & Plano Clark, 2012:269). Delpont and Fouché (2013:440-443) and Ivankova et al. (2012:272-276) distinguish four major types of mixed methods research designs, namely explanatory, exploratory, triangulation and embedded mixed methods designs. In this study an **explanatory mixed methods** design was employed since both quantitative and qualitative data were used to illuminate the research problem. According to Ivankova et al. (2012:272) “the word *explanatory* in the design name suggests that the qualitative findings help explain the quantitative results”.

3.5 STRATEGIES OF INQUIRY

Creswell (2009:11) maintains that the researcher should not only select a research design in the form of a quantitative, qualitative or mixed methods design, but should also decide on a type of study within these three choices. Therefore, “strategies of inquiry are types of qualitative, quantitative and mixed methods designs ... that

provide specific direction for procedures in a research design” (Creswell, 2009:11). Understood in this way, the overall strategy of inquiry applied in this study can be typified as **sequential explanatory mixed methods**. Creswell and Plano Clark (2011:71) assert that the explanatory mixed methods research design is sequential in nature since two distinct but interactive phases could be distinguished. In the case of this study, the first phase comprised the collection of quantitative data from Grade 9 Technology teachers and their learners. During the second phase, qualitative data were collected from subject facilitators in the field of Technology. This sequencing implied that the quantitative part of the study was prioritised since two groups of respondents (teachers and learners) from diverse school settings contributed towards the research data. The secondary or qualitative part of the study enlightened the results obtained in the first phase. Although the two data sets were collected and analysed independently from each other, they were used complementarily during the interpretation of the research results. Since the sequential explanatory mixed methods comprised both quantitative and qualitative approaches, strategies of inquiry can also be identified within these approaches.

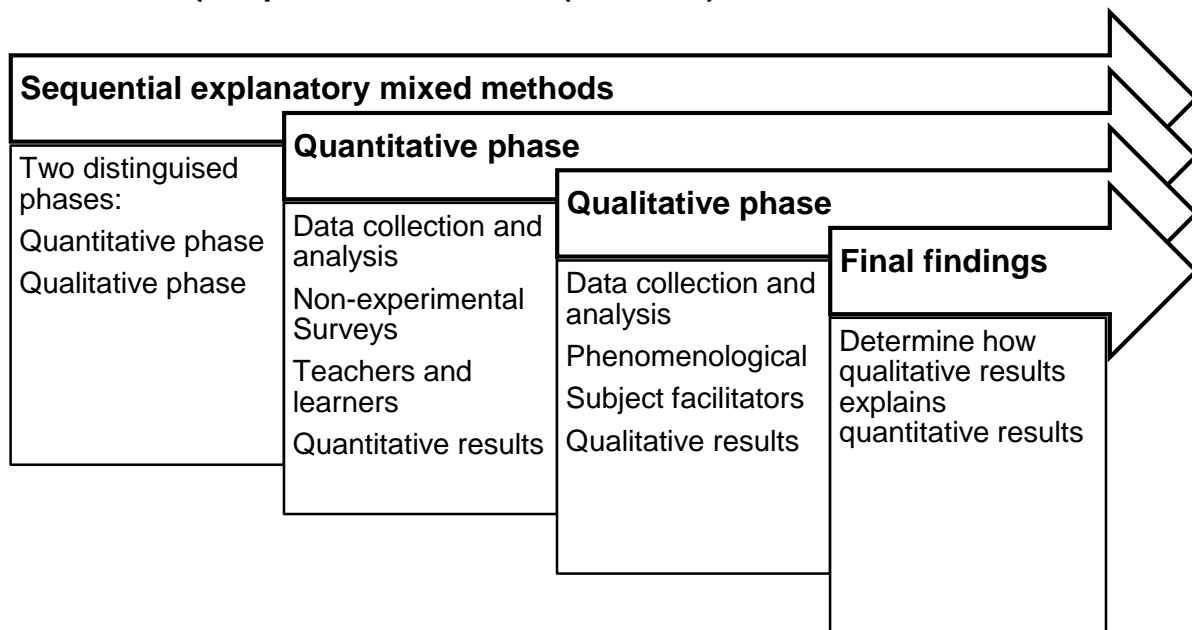
For the quantitative part of this study, non-experimental research in the form of a **survey** was used. According to Kowalczyk (2015) non-experimental research is research in which the researcher cannot control, manipulate or alter the predictor variable or respondents, but instead, relies on interpretation, observation or interactions to reach a conclusion. Within non-experimental research, surveys are probably the most widely used strategy of inquiry (Fouché, Delport & De Vos, 2012:156). Surveys are mainly descriptive in nature since they are used to describe attitudes, beliefs and opinions and allow “that information about a large number of people can be inferred from the responses obtained from a sample” (McMillan & Schumacher, 2014:30, 31). Since the intention of the study was to gather the opinions of a sample of Grade 9 Technology teachers and their learners on the determinants that affect Grade 9 learners’ selection of subjects in the field of Technology for the FET Phase, a survey was considered the most appropriate strategy of inquiry for the quantitative part of the study.

For the qualitative part of the study a **phenomenological** strategy of inquiry was used. Phenomenological research is described by Creswell (2009:13) as “a strategy of inquiry in which the researcher identifies the essence of human experiences about

a phenomenon as described by the participants”. Delport, Fouché and Schurink (2012:305) define a phenomenological study as one “that attempts to understand people’s perceptions, perspectives and understanding of a particular situation”. In this strategy of inquiry it is important that the researcher gains access to individuals who have first-hand experience of a particular phenomenon and who are able to describe it (Plano Clark & Creswell, 2010:239). To successfully apply this strategy it is necessary that the researcher “brackets” or sets aside personal experiences in order to understand those of the participants (Creswell, 2009:13).

In Figure 3.1 the sequential, explanatory research design as employed in this study is depicted.

Figure 3.1: Application of the sequential, explanatory research design (Adapted from Creswell (2015:544))



3.6 POPULATION AND SAMPLING

Plano Clark and Creswell (2010:182) explain a population as “a group of individuals who have the same characteristic”. McMillan and Schumacher (2014:5) state that a population is a group of individuals or events from which a sample is drawn and to which results can be generalised. The study population applicable to this research was all the Grade 9 Technology teachers and their learners and the Technology subject facilitators in South Africa. However, for reasons beyond the control of the researcher it was not possible to include these individuals from outside the borders of the Sedibeng area. The population was thus restricted to the Sedibeng East (D7)

and Sedibeng West (D8) districts. In these two districts there were seventeen (17) secondary public schools (ex-Model C schools as well as Township schools), which offered FET subjects in the field of Technology during the time of the research. By applying non-probability, purposive sampling (Strydom, 2012:232), all 17 these schools were included in the study since all of them offered subjects in the field of Technology from which learners can choose to continue to the FET phase.

Subsequently, teachers and learners were sampled to participate in the quantitative part of the study. All teachers (n=17) teaching Grade 9 Technology in the 17 selected schools were identified to participate in the quantitative part of the study. These teachers were also selected by means of purposive sampling since they satisfied the criteria required for the purpose of the study. These criteria included that teachers should teach Grade 9 Technology in either the D7 or D8 districts. Eventually, only ten (10) of the selected teachers were willing to participate in the research. By applying systematic random sampling (Strydom, 2012:230), using class lists and intervals of every tenth learner, Grade 9 learners of the selected 17 schools were sampled. By following the guidelines provided by Leedy and Ormrod (2005:207) as well as McMillan and Schumacher (2010:141), the size of the learner sample was estimated at three hundred (300) which represented at least ten per cent (10%) of the Grade 9 learners in the sampled schools. The estimated sample size was calculated according to the following formula: 17 schools x 5 Grade 9 classes per school (average) x 40 learners per class (average) = 3400 learners. Based on the real figures of learner enrolment in the two districts, a total of 388 learners were finally included in the sample to participate in the research.

For the qualitative part of the study the Technology subject facilitators from both the districts were purposively sampled. The criteria adhered to were that subject facilitators should come from the field of Technology and either the D7 or D8 districts. Although there were eight (8) facilitators satisfying the stated criteria during the time of the study, only three were readily available to participate in the research.

3.7 DATA COLLECTION METHODS

The data for this study were collected by means of questionnaires and interviews.

3.7.1 Questionnaires

Questionnaires designed by the researcher were used to collect the quantitative data from the sampled teachers and learners. The questions of the questionnaires were informed by the literature study and the researcher's encounters with learners' subject choices in the field of Technology. Both the teacher and learner questionnaire comprised of close-ended questions. Although Fraenkel and Wallen (2008:396) warn that close-ended questions could limit the depth of responses, Delpont and Roestenburg (2012:198) assert that such questions could be meaningful in ascertaining the degree, frequency and comprehensiveness of a phenomenon. By following the guidelines provided by Maree and Pietersen (2012:161-168), biographical, dichotomous, multiple choice, ranking and four point Likert scale items were constructed and included in both questionnaires. The teacher questionnaire contained five sections and 16 questions, while the learner questionnaire covered six sections and 10 questions. The researcher attempted to ensure compatibility between the items of the teacher and learner questionnaires, since it was argued that this would assist in identifying and reporting convergent and divergent data. The following suggestions provided by Leedy and Ormrod (2005:190-192) were used as guidelines for constructing and administering the questionnaires:

- the questionnaires were kept short and to the point;
- easy and uncomplicated terminology was used;
- the researcher steered clear from unwanted assumptions;
- no clues were given to obtain a preferred response;
- instructions were clear and simple for both teachers and learners to follow;
- the purpose of the questionnaires was well explained before completion, and
- the questionnaires were designed to appear professional.

Both questionnaires were administered by the researcher. The teacher questionnaire was personally delivered to each of the sampled respondents. After the questionnaire was introduced, teachers were allowed to complete the questionnaire on their own time. Arrangements were made for the collection of the questionnaire. In the case of the learners, a *group administered procedure* (Delpont & Roestenburg, 2012:189) was followed. Arrangements with the principals of the sampled schools were made to complete the questionnaires during break times in a single venue. The researcher personally administered the questionnaire as

arranged with the respective schools. All learner questionnaires were collected immediately after completion. For both of the questionnaires, provision was made for 20 minutes completion time.

3.7.2 Interviews

For the qualitative part of the study individual semi-structured, face-to-face interviews were conducted with the sampled Technology subject facilitators. According to Nieuwenhuis (2012b:87) the aim of a qualitative interview is “to see the world through the eyes of the participant”. Creswell (2015:217) states that individual, face-to-face interviews are ideal for interviewing participants who are not hesitant to speak, who are articulate, and who can share ideas comfortably. Since the intention of the qualitative part of the study was to illuminate the quantitative results, semi-structured interviews were preferred. Nieuwenhuis (2012b:87) alludes to the fact that semi-structured interviews are characterised by a set of predetermined questions which allows for consistency and the probing and clarification of responses. Hence, an interview guide consisting of nine key questions which allowed for further exploration and probing was constructed. The interview guide was constructed by keeping the following guidelines provided by Bryman (2012:473) in mind:

- questions were grouped according to areas of concern;
- the formulation of questions was guided by the purpose of the research;
- questions were phrased in comprehensible language, and
- leading questions were avoided.

Arrangements were made with the individual sampled interviewees for scheduling the interview sessions at convenient times. Provision was made for 30 minute interview sessions. All the interviews were conducted in the participants’ offices or in appropriate venues at the district offices. The following practical details concerning the preparation for interview sessions as suggested by Bryman (2012:473, 474) were observed:

- familiarising oneself with the settings in which the interviewees work;
- ensuring that recording facilities are in working condition;
- ensuring that the venue is quiet and private;
- be prepared to be a good listener to enable probing where necessary, and

- avoiding judging responses.

All interviews were conducted by the researcher. The interviews were audio-taped to enable the researcher to transcribe each interview to facilitate analysis and interpretation.

3.8 QUALITY CRITERIA

To obtain conclusive results by means of the empirical study, the researcher applied a variety of measures. Based on the fact that this is a mixed methods study, it is evident that **triangulation** was observed. According to De Vos (2005:361) triangulation authorises the researcher to have confidence in the research results and enhances the transferability of the study's results. For the purpose of this study, methodological and data triangulation were ensured. Methodological triangulation (De Vos, 2005:362) was done by applying both quantitative and qualitative approaches to reinforce each other within the mixed methods research design. Data triangulation (De Vos, 2005:362) was incorporated in the form of different data collection instruments such as questionnaires and interviews.

Delpont and Roestenburg (2012:172) postulate that “validity and reliability are two of the most important concepts in the context of measurement”. Leedy and Ormrod (2005:28) state that “the validity of a measurement instrument is the extent to which the instrument measures what it is supposed to measure”. To ensure **internal validity** or the degree to which the research design and data would yield accurate conclusions (Leedy & Ormrod, 2005:97), face and content validity (Pietersen & Maree, 2012:217) were applied. This was done by verifying if all the questionnaire and interview questions were related to the focus of the research based on their face value and by considering the content associated with the phenomenon (factors impacting on subject choices in the field of Technology) being measured. The multiple data sources as referred to under triangulation above, assured **external validity** or the extent to which the conclusions drawn from the research can be generalized to other contexts (Leedy & Ormrod, 2005:99; McMillan & Schumacher, 2010:265). **Reliability** refers to the stability or consistency of the measurement and is mainly concerned with “how well” something is measured (Delpont & Roestenburg, 2012:177, 178). To ensure the reliability of the research instruments the researcher drew on the advice from Pietersen and Maree (2012:215). As a result, all the

questions of the data collection instruments were examined to check that they were carefully worded so that their intended meanings are clear to all participants; that possible leading questions, which could influence participants to respond in a particular way, were eliminated, and by removing double-barrelled questions where the same question has many parts. The Cronbach Alpha reliability co-efficient was also applied to ensure the reliability of selected questionnaire items. A pilot study was also done to verify the validity and reliability of the data collection instruments.

To guarantee the trustworthiness of the interview data in the qualitative part of the study, **credibility** (Schurink, Fouché & De Vos, 2012:346) was ensured by orally recording the responses of the research participants on tape during the interviews. According to Bryman (2012:49) credibility is concerned with how believable the findings are and therefore it parallels internal validity. **Dependability**, which is seen as the alternative to reliability (Schurink, Fouché & De Vos, 2012:420), was ensured by examining the documentation, such as the interview notes and interpretations made by the researcher to secure accuracy in terms of changing conditions. For **conformability** (Schurink, Fouché & De Vos, 2012:421) or for ensuring unbiased, objective findings, the researcher based all interpretations solely on the raw data gathered from the recorded audio-tapes and requested a knowledgeable person in the field of qualitative data analysis to act as peer reviewer to verify the verbatim transcripts with the findings.

3.9 THE PILOT STUDY

According to Leedy and Ormrod (2005:110) a pilot study is “a brief exploratory investigation ... to try out particular procedures, measurement instruments, or methods of analysis” to ascertain the feasibility of a study. Metaphorically, Strydom (2012:237) refers to a pilot study as “a dress rehearsal” of the main investigation. The value of a pilot study lies in the fact that it could help to improve the success and effectiveness of a study (Strydom, 2012:241).

With reference to this particular study, the pilot study mainly served to ensure the reliability and validity of the research instruments. Both the teachers' and learners' questionnaire were appraised by distributing it to conveniently sampled respondents who were not included in the main study but matched the profile of the sampled respondents. The questionnaires were completed in the presence of the researcher.

After completion, a feedback session was arranged to allow respondents to share any views regarding the questionnaires. No particular issues were raised by any of the respondents. By using the prepared interview guide, one subject facilitator in the field of Technology of a neighbouring district was interviewed. After the interview the facilitator revealed that the interview questions were clear and relevant to the intended purpose of the study. Despite conducting the pilot study on the interview questions the researcher was still concerned about his own ability to conduct the interviews successfully by also utilising probing questions and was reminded that “the practical situation will remain an unknown factor until it is entered” (Strydom, 2012:237).

3.10 THE ROLE OF THE RESEARCHER

Being conscious about his position in “interactive data collection” (McMillan & Schumacher, 2006:344) and as teacher education lecturer in the field of Technology at the North-West University, that may impact on the research results, the researcher was obliged to eliminate factors such as “biases, values and personal background” (Creswell, 2009:177). Consequently, the researcher conformed to “a range of strategic, ethical, and personal issues” (Creswell, 2009:177) to ensure undistorted research results. These issues related, inter alia, to the researcher’s approach to data collection. Therefore, the researcher reacted mindfully to protect the rights and welfare of all the research participants and dealt with this in an ethically responsible manner. Questionnaires and interviews were administered by exercising caution to ensure relaxed circumstances; not disrupting the research participants’ routine; not causing any inconvenience to any of the participants or intrude on any participants’ privacy. Furthermore, the researcher was especially sensitive about “whose voice is being recorded as data” (McMillan & Schumacher, 2006:345) and eliminated any personal interferences with the data as far as possible.

In accordance with the suggestions of Creswell (2009:177) and Maree and van der Westhuizen (2012:41) concerning the role of the researcher to ensure the successful completion of the research, the researcher personally:

- obtained permission from relevant structures and individuals to conduct the research;
- compiled and administered the questionnaires;

- compiled, administered and conduct the interviews, and
- analysed and interpreted the data.

3.11 ETHICAL CONSIDERATIONS

Strydom (2012:114) provides the following comprehensive definition of ethics: “a set of moral principles which is suggested by an individual or group, is subsequently wider accepted, and which offers rules and behavioural expectations about the most correct conduct towards experimental subjects and respondents, employers, sponsors, other researchers, assistants and students”. Quoting Schnell and Heinritz (2006), Flick (2014:49, 50) mentions the following set of principles concerning the ethics of doing research:

- the necessity of the research should be justifiable;
- the aim of the research and the circumstances under which participants will be involved should be made explicit;
- the methodological procedures should be clarified;
- an estimation of the positive or negative impact of the research should be made;
- possible violations and damages arising from doing the research should be anticipated, assessed and as far as possible prevented;
- no false statements about the usefulness of the research results should be made, and
- regulations of data protection should be respected.

The researcher conformed to the above principles and adhered to the ethical guidelines as suggested by Leedy and Ormrod (2005:102) and Creswell (2009:92) by doing the following:

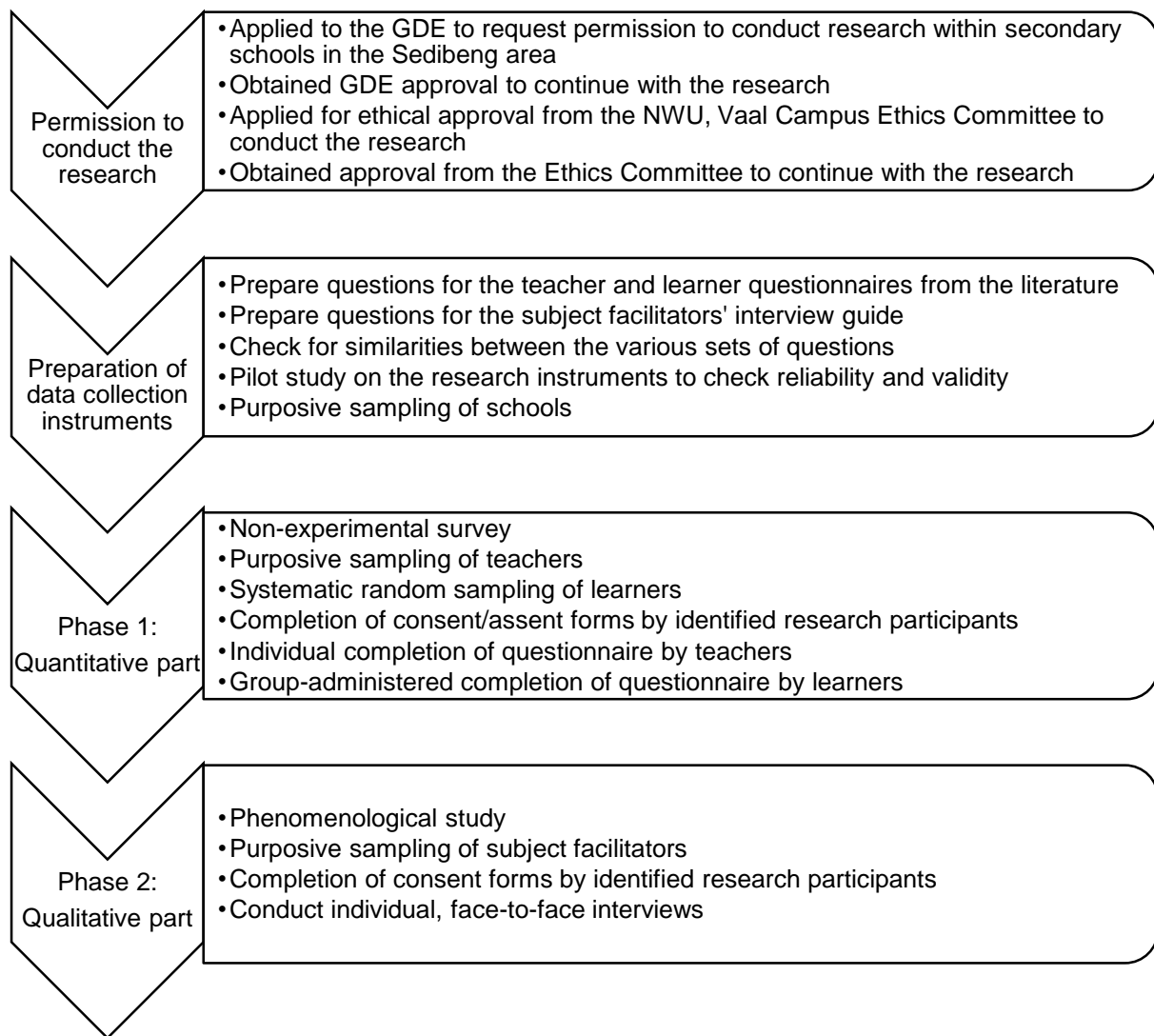
- After submitting the research request to the Gauteng Department of Basic Education, approval was obtained to conduct the research.
- After submitting an application to conduct the research was submitted to the Ethical committee of the North-West University, Vaal Campus, approval was obtained to continue with the research.

- School principals, teachers, learners and their parents, as well as Technology subject facilitators were consulted to obtain their permission to participate in the research.
- Participants were provided with a description of the aim and nature of the research, what their participation will involve as well as a statement indicating that their participation is anonymous and voluntary, and that their responses will be treated confidentially and only used for research purposes.
- All the research participants signed an informed consent/assent form before the research commenced.
- Completion of questionnaires and participation in interviews were scheduled in accordance with the participants' obligations and it was ensured that this did not interfere with teaching and learning activities.
- The proposed research was based on sound data and findings, obtained from the actual empirical study and the researcher avoided the falsifying or invention of findings, as this is regarded as scientific misconduct.

3.12 THE DATA COLLECTION PROCESS

The data collection process is visually represented in Figure 3.2 on the next page. The study, which was empirically based on a sequential, explanatory mixed methods design, included the stages of data collection as outlined below.

Figure 3.2: Data collection process



3.13 CONCLUSION

In this chapter, the research methodology as applied in this research was clarified and discussed. Relevant elements such as the paradigm, research design, strategies of inquiry, sampling, instruments, quality criteria, pilot study, the researcher's role and ethics were received attention. The chapter was concluded by an outline of the data collection process.

In the following chapter the quantitative and qualitative data will be presented, analysed and interpreted.

CHAPTER 4

DATA ANALYSIS AND INTERPRETATION

4.1 INTRODUCTION

In the previous chapter, the processes and procedures of the empirical study to gather appropriate information for addressing the purpose of the study were discussed. In this chapter, the empirical data obtained by means of the questionnaires to teachers and learners and the interviews of the subject facilitators, will be analysed and interpreted. Comparisons and links will also be made between the different sets of data. Consequently, the chapter envisage addressing the primary research question:

What are the determinants affecting Grade 9 learners' selection of subjects in the field of Technology for the FET Phase in the Sedibeng area?

4.2 QUANTITATIVE DATA ANALYSIS AND INTERPRETATION

4.2.1 Background information

In this section the quantitative data as obtained through the questionnaires to teachers and learners will be analysed and interpreted. For this study, quantitative data were collected from 10 teachers and 388 learners from 17 secondary schools in the Sedibeng D7 and D8 districts.

4.2.2 Teachers' questionnaire

4.2.2.1 Section A: Biographical information

4.2.2.1.1 *Gender*

From the sampled teachers' responses to Question1, 60% are male and 40% are female. Based on the general assumption that there are more female than male teachers in the South African Basic Education system, the data in Table 4.1 reflect that there are probably more males teaching Technology subjects than females.

Table 4.1: Gender composition of sampled teachers

Gender	Frequency	Percentage
Male	6	60
Female	4	40
Total	10	100

4.2.2.1.2 Age

While 20% of the sampled respondents fall in the age group 20 to 35 years, the age of another 20% ranges between 56 and 60+ years. However, the majority or 60% of the sampled respondents indicated in Question 2 that they are between 36 and 55 years of age. From the information in Table 4.2 it can be inferred that in terms of age, the sampled respondents can be regarded as experienced teachers.

Table 4.2: Age of the sampled teachers

Age	Frequency	Percentage
20 - 25 years	1	10
26 - 35 years	1	10
36 - 45 years	3	30
46 - 55 years	3	30
56 - 60 years	1	10
60+ years	1	10
Total	10	100

4.2.2.1.3 Teaching experience

Four questions focused on the sampled teachers' teaching experience. Question 3 of the questionnaire concentrated on the respondents' overall teaching experience (Table 4.3) while Questions 4 and 5 centred on the respondents' teaching experience in Technology in the GET and FET phases respectively (Figure 4.1). In Question 10 respondents were required to indicate their teaching experience with reference to particular FET subjects in the field of Technology.

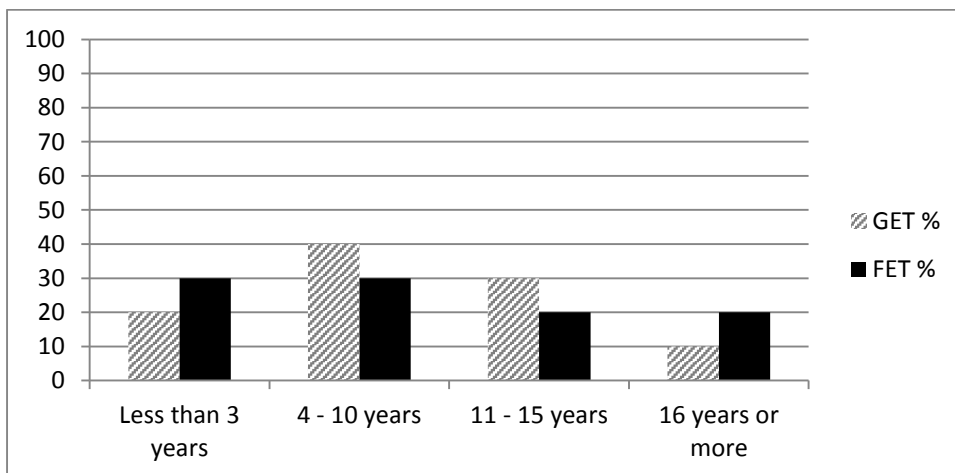
Table 4.3: Total years of teaching experience

Years	Frequency	Percentage
Less than 5 years	2	20
5 - 10 years	1	10
11 - 20 years	4	40
21 - 30 years	2	20
31 years or more	1	10
Total	10	100

Table 4.3 shows that 30% of the respondents has ten years or less teaching experience and another 30% has 21 and more years teaching experience. The largest single group of respondents (40%) has 11 to 20 years teaching experience. This implies that 70% of the respondents have more than 11 years teaching experience and can be regarded as knowledgeable, skilled and competent teachers. Furthermore, the information suggests that an almost equal proportion of the sampled teachers were trained before and after the implementation of C2005 in which Technology as subject was initially included.

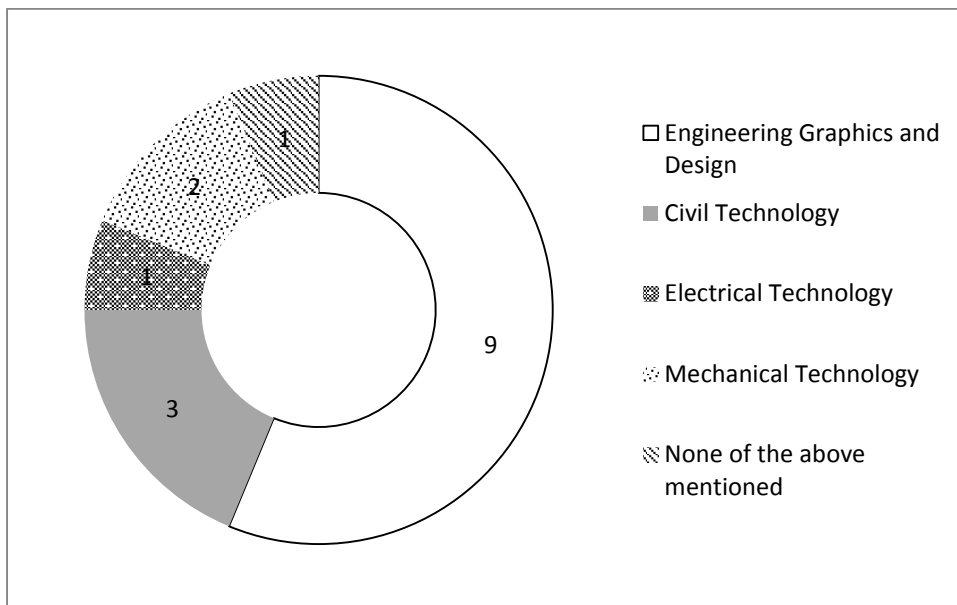
According to Figure 4.1 below, 60% of the sampled respondents have ten years or less teaching experience in the field of Technology in the GET as well as in the FET phases, compared to 40% of the respondents who have 11 years or more teaching experience in the GET phase.

Figure 4.1: Years' teaching experience in Technology in the GET and FET phases



Nine of the respondents indicated that they have teaching experience in Engineering Graphics and Design followed by respectively three respondents who have teaching experience in Civil Technology and two who have teaching experience in mechanical Technology. Only one respondent have experience in teaching Electrical Technology. One of the respondents has no teaching experience in any of the listed FET subjects. The respondents' replies reflect the fact that most South African universities include primarily Engineering Graphics and Design in their teacher education programmes aimed at Technology education in the FET phase.

Figure 4.2: Years' teaching experience in FET subjects in the field of Technology



4.2.2.1.4. Qualifications

Questions 6 and 7 were respectively concerned with the respondents' teacher education qualifications (Table 4.4) and their qualifications in the field of Technology (Table 4.5).

Table 4.4: Highest teacher education qualifications

Qualification	Frequency	Percentage
Certificate	0	0
Diploma	4	40
3 year degree plus Diploma	3	30
4 year degree	1	10
Honours degree	1	10
Master's degree	0	0
PhD	0	0
Other (please specify)	1	1
Total	10	100

From the data reflected in Table 4.4, 40% of the respondents indicated that their highest teacher education qualification is a diploma, while 30% of the respondents hold a three year degree and a diploma. Only one respondent possesses a four year degree while another one has an honours degree.

Table 4.5: Highest qualification in the field of Technology

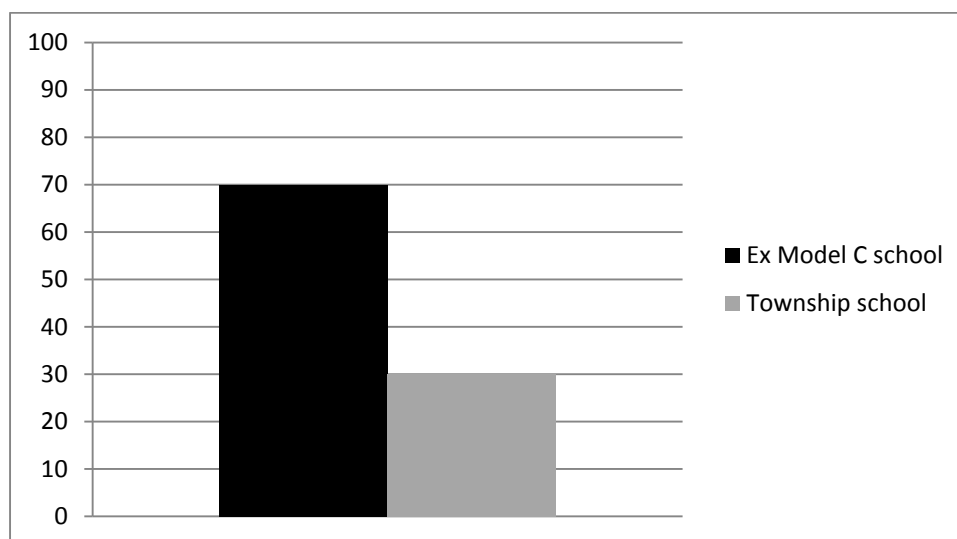
Qualification	Frequency	Percentage
Grade 12 or lower	1	10
N1-N2	0	0
N3-N4	0	0
N5-N6	0	0
Artisanship	2	20
1 st year higher education qualification	1	10
2 nd year higher education qualification	1	10
3 rd year higher education qualification	4	40
Honours degree	1	10
Master's degree	0	0
PhD degree	0	0
Total	10	100

It is evident from the data in Table 4.5 that 70% of the respondents have some sort of university qualification in the field of Technology Education which could imply a more academic-oriented qualification, while 20% of the respondents hold a more practical-oriented qualification in the form of an artisanship. One (10%) of the respondents indicated that he/she was not trained beyond Grade 12 in the field of Technology.

4.2.2.1.5 *Type of school and post level*

Based on Question 8 of the questionnaire, Figure 4.3 reflects the type of school where the research respondents are teaching. Two types of schools were distinguished: ex- Model C schools where 70% of the respondents are teaching and Township schools where 30% of the respondents are employed. All the sampled respondents are employed as teachers (Question 9).

Figure 4.3: Type of school



4.2.2.2 Section B: Awareness related to Technology as subject

In this section three questions were asked in order to establish the degree to which respondents are informed about Technology as subject and what they do to promote it.

4.2.2.2.1 *Additional information regarding Technology as subject*

In reaction to Question 11, Table 4.6 shows that most (60%) of the sampled respondents are of the opinion that their colleagues responsible for teaching

Technology at school level share information by providing them “regularly” or “almost always” with additional information regarding Technology as subject. Less than half of the respondents (40%) indicated that District Subject facilitators and the responsible HODs provide additional information “regularly” or “almost always” while only 30% of the respondents revealed that the Department of Basic Education provide them with sources on a regular basis. Responses show that involvement by the education sector (e.g. Higher Education Institutions) or the private sector (e.g. Industries) is regarded as weak since 90% of the respondents indicated that these sectors “almost never” or “now and then” provide additional information. From the data it appears as though relations between schools offering Technology as subject and the education and private sectors could be improved in order to promote the subject better and to keep up with technological advancements.

Table 4.6: Sources of additional information

Source	Almost Never		Now and then		Regularly		Almost always	
	n	%	n	%	n	%	n	%
District Subject facilitator	3	30	3	30	2	20	2	20
Responsible HOD	2	20	4	40	3	30	1	10
Sources within the Department of Basic Education	2	20	5	50	3	30	0	0
Sources within the education sector (e.g. FET Colleges, Higher Education Institutions)	5	50	4	40	1	10	0	0
Sources within the private sector (e.g. Industries, Mining houses)	7	70	2	20	1	10	0	0
Colleagues responsible for teaching Technology at school level	2	20	2	20	4	40	2	20
Other stakeholders not mentioned above	7	70	1	10	1	10	0	0

4.2.2.2.2 *Self-study activities to broaden competence of Technology as subject*

The sampled respondents' engagement with the listed self-study activities in Question 12 (Table 4.7) is somewhat disturbing since there is an almost equal divide between "almost never" and "now and then" on the one hand and "regularly" and "almost always" on the other. Reading hard copy sources such as articles or books and participation in discussion groups/subject groups appear to be the most prominent self-study activities as 60% of the respondents indicated that they engage in these "regularly" or "almost always". Given the time and era that we are living in, one would assume that more respondents would be using the internet platform to engage in self-study activities. Also surprisingly is the fact of the rather low involvement of respondents in attending organised exhibitions related to Technology as subject and visiting sites of technological importance.

Table 4.7: Engagement with self-study activities

Activities	Almost never		Now and then		Regularly		Almost always	
	n	%	n	%	n	%	n	%
Reading hard copy sources such as articles or books	0	0	4	40	4	40	2	20
Reading electronic sources on the internet	4	40	1	10	4	40	1	10
Participation in discussion groups / subject groups	2	20	2	20	5	50	1	10
Attending organised exhibitions related to Technology as subject	1	10	4	40	2	20	3	30
Visiting places or sites of technological importance (e.g. Eskom)	4	40	2	20	4	40	0	0

4.2.2.2.3 *Involvement in the promotion of Technology as subject*

Considering their responses to "regularly" and "almost always" in Question 13 (Table 4.8), it appears as though most respondents are promoting Technology as subject by means of organising in-school displays, presentations or demonstrations (70%); by providing subject guidance (80%), and by sharing interesting facts regarding the

subject or career prospects related to the subject with parents (70%). A significant number of respondents (70%) indicated that they “almost never” or only “now and then” organise fieldtrips to promote Technology as subject. This could be ascribed to expenses to realise such trips.

Table 4.8: The promotion of Technology as subject

I actively promote Technology as subject beyond formal teaching and learning situations by	Almost never		Now and then		Regularly		Almost always	
	n	%	n	%	n	%	n	%
organizing in-school displays, presentations or demonstrations	2	20	1	10	6	60	1	10
providing subject guidance	1	10	1	10	5	50	3	30
organizing fieldtrips	5	50	2	20	3	30	0	0
sharing interesting facts regarding the subject or career prospects related to the subject with parents	2	20	1	10	7	70	0	0

4.2.2.3 Section C: Teaching competence

According to the responses to Question 14 (Table 4.9) it is evident that almost all the sampled respondents are convinced that they are “often” and “nearly always” competent in teaching Technology. However, it is interesting to note that some of the respondents (although only 20%), are sceptical about their ability to demonstrate practical skills related to Technology in a comprehensible manner; to relate Technology subject content to real life situations; to solve problems experienced by individual learners in the subject and to vary their teaching methods.

Table 4.9: Technology teachers' views regarding their teaching competence

I...	Very little		Some what		Often		Nearly always	
	n	%	n	%	n	%	n	%
can explain Technology subject content effortlessly	0	0	0	0	3	30	7	70
can demonstrate practical skills related to Technology in a comprehensible manner	1	10	1	10	6	60	2	20
can clarify difficult aspects of the subject sensibly	0	0	0	0	6	60	4	40
can relate Technology subject content to real life situations	0	0	2	20	4	40	4	40
am sensitive towards problems experienced by individual learners in the subject	0	0	1	10	7	70	2	20
can solve problems experienced by individual learners in the subject	0	0	2	20	4	40	4	40
can vary my teaching methods in the subject	0	0	2	20	4	40	4	40
can structure interesting learning activities in the subject	0	0	0	0	9	90	1	10
can stimulate learners' creative thinking in the subject	0	0	0	0	6	60	4	40
can stimulate learners' critical thinking and problem solving skills in the subject	0	0	1	10	8	80	1	10
can set assessment tasks in Technology with confidence	0	0	0	0	8	80	2	20
can provide learners with guidance concerning their Technology subject choices for the FET phase	0	0	0	0	6	60	4	40

4.2.2.4 Section D: Teachers' views regarding Technology as subject

Table 4.10: Views regarding Technology as subject

The subject Technology....	Very little		Some what		Often		Nearly always	
	n	%	n	%	n	%	n	%
contributes in the development of a technological literate society	1	10	2	20	5	50	2	20
stimulates learners to be innovative	0	0	1	10	7	70	2	20
develops learners' creative thinking skills	0	0	1	10	6	60	3	30
develops learners' critical thinking and problem solving skills	0	0	1	10	5	50	4	40
fosters teamwork	1	10	1	10	5	50	3	30
introduces learners towards the basics required for the FET subject: Civil Technology	0	0	3	30	3	30	4	40
introduces learners towards the basics required for the FET subject: Mechanical Technology	0	0	1	10	6	60	3	30
introduces learners towards the basics required for the FET subject: Electrical Technology	0	0	2	20	4	40	4	40
introduces learners towards the basics required for the FET subject: Engineering Graphics and Design	0	0	1	10	6	60	3	30
provides learners with relevant knowledge and experiences to take informed decisions about career-oriented subject choices at the end of Grade 9	1	10	1	10	5	50	3	30

Generally, the respondents reacted positively towards the factors listed in Question 15 (Table 4.10). However, some of the respondents expressed their doubt about the contribution of Technology in developing a technological literate society (30%), that Technology fosters teamwork (20%), that Technology introduces learners towards the basics for Civil Technology (30%) and Electrical Technology (20%). Although a small portion (20%), some respondents also indicated that Technology does not

necessarily provide learners with the relevant knowledge and experience to take informed decisions about career-oriented subject choices at the end of Grade 9.

4.2.2.5 Section E: Teachers' views regarding challenges in Technology

Concerning Question 16 (Table 4.11), the majority of the sampled respondents expressed the view that to a large extent, all the listed challenges impact on the popularity of Technology. However, learners' attitudes towards the subject and the availability of technology sources within schools were highlighted by almost all the respondents (90%) as the most challenging factors impacting on the popularity of Technology.

Table 4.11: Challenges impacting on the popularity of the subject Technology

The following challenges impact on the popularity of Technology:	Very little		Some what		Often		Nearly always	
	n	%	n	%	n	%	n	%
Quality of Technology teacher education programs	0	0	2	20	5	50	3	30
Teachers' general Technology knowledge	0	0	2	20	3	30	5	50
Teachers' attitudes towards the subject Technology	0	0	2	20	1	10	7	70
Learners' attitudes towards the subject Technology	0	0	1	10	5	50	4	40
Parents' attitudes towards the subject Technology	0	0	2	20	4	40	4	40
The availability of technology resources within schools	0	0	1	10	4	40	5	50

4.2.2.6 Preliminary findings from the teachers' questionnaire

Although the responses to the teachers' questionnaire stimulated some curiosity, the teacher sample was too small to yield and report information beyond descriptive data. Hence, the researcher found it necessary to examine the data obtained from the learners' questionnaire from a descriptive as well as from an inferential point of view.

4.2.3 Learners' questionnaire

4.2.3.1 Reliability of the learners' questionnaire

Since it is the researcher's intention to consider the data obtained from the learners' questionnaire more critically by also applying inferential statistics, it is essential to determine the reliability of applicable questionnaire items. As a result the Cronbach Alpha coefficients were calculated to determine the internal consistency of Questions 5, 6, 7 and 8 of the learners' questionnaire. According to Akbaba (2006:183) the Cronbach Alpha is a reliability coefficient that calculates the extent to which items, such as found in a questionnaire, are correlated positively to one another. McMillan and Schumacher (2014:198) indicate that Cronbach's alpha is used for measuring consistency among individual items in a scale and it requires at least three questions that measure a particular trait. Sekaran (2000) and Bryman (2012:170, 280) point out that the internal consistency reliability of questionnaire items become higher as the Cronbach Alpha moves closer to 1. In most Social Sciences a Cronbach Alpha coefficient between 0.70 and 0.80 is regarded as acceptable (Simon, 2008; Bryman, 2012:280). The Cronbach Alpha reliability coefficients calculated to measure the internal consistency of the applicable items in the learners' questionnaire are shown in Table 4.12.

Table 4.12: Cronbach Alpha coefficients and inter-item correlations of applicable questionnaire items

Question	Cronbach Alpha coefficient	Items	Inter-item correlation (mean)
5	.631	5	.255
6	.646	4	.313
7	.813	12	.267
8	.779	10	.261

Although some coefficients are below the acceptable indicators, 0.60 could still be regarded as in order for an exploratory study (Simon, 2008; Garson, 2008). Gopelwar (2014:6) suggests that an average inter-item correlation between 0.15 - 0.50 yields a reliable value for internal consistency. Although the Cronbach Alpha's for Questions 5 (.631) and 6 (.646) were just above 0.60, their respective inter-item correlations (.255 and .313) yielded reliable values. The low Cronbach Alpha values

for Questions 5 and 6 could be attributed to the few items included under each of these questions.

In the following sections the data from the learners' questionnaire will be analysed and interpreted.

4.2.3.2 Section A: Biographical information

4.2.3.2.1 *Gender*

According to the responses to Question 1, the gender composition of the sampled learners is balanced, since 51% are males and 49% females as reflected in Table 4.13. The more or less equal gender composition of the respondents could contribute towards a more truthful account of learner views regarding possible determinants impacting on subject choices.

Table 4.13: Gender composition of sampled learners

Gender	Frequency	Percentage
Male	197	51
Female	191	49
Total	388	100

4.2.3.2.2 *Grade 9 history*

Table 4.14 reflects the Grade 9 history of the sampled learners. According to the data obtained from Question 2, most of the respondents (92%) are doing Grade 9 for the first time while 8% are repeating the grade. It could therefore be concluded that it is most of the respondents' first encounter with subject choices for the FET phase.

Table 4.14: Grade 9 history of sampled learners

History	Frequency	Percentage
1 st year in Grade 9	358	92
Repeating Grade 9	30	8
Total	388	100

4.2.3.2.3 Type of school

Realising that the type of school could impact on the research results, but due to logistical considerations, the researcher was able to access more ex-Model C schools. Therefore, Table 4.15 reflects that 73% of the respondents came from ex-Model C schools and 27% from Township schools (Question 3).

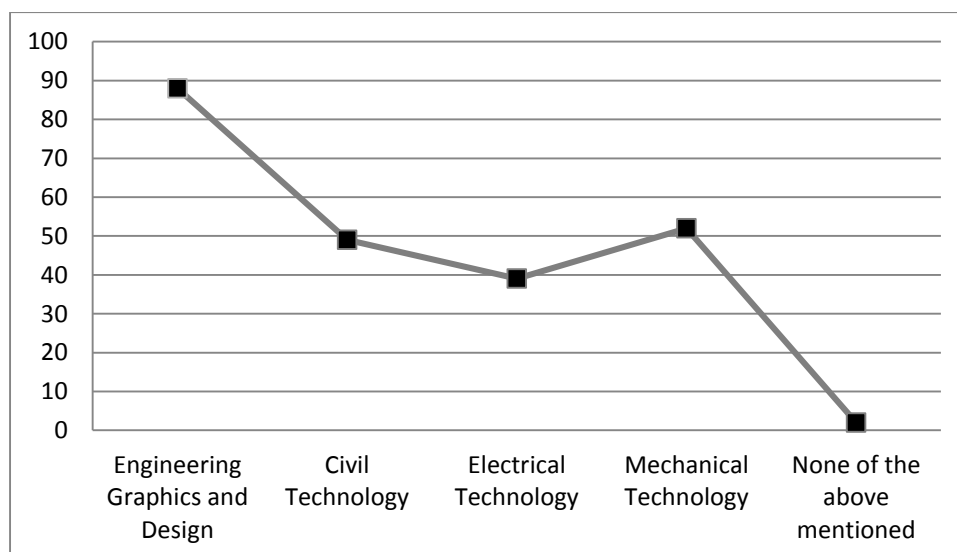
Table 4.15: Type of school

School	Frequency	Percentage
Ex Model C school	283	73
Township school	105	27
Total	388	100

4.2.3.2.4 Offering of FET subjects in the field of Technology

From the data obtained from Question 4 which are represented in Figure 4.4, it is noticed that, according to the sampled learners' knowledge, significantly more schools (88%) are offering Engineering Graphics and Design than any other of the FET subjects in the field of Technology. Noteworthy is also the fact that more schools offer Mechanical Technology (52%) and Civil Technology (48%) than Electrical Technology (39%). This state of affairs could be as a result of the qualifications of teachers appointed to teach these subjects or the financial implications to offer certain subjects.

Figure 4.4: Available FET subjects in the field of Technology



4.2.3.3 Factor analysis

4.2.3.3.1 Orientation

As indicated in 4.2.3.1, selected questions will be subjected to inferential statistics in order to conceptualise the possible determinants affecting Grade 9 learners' selection of subjects in the field of Technology for the FET Phase in the Sedibeng area. For this purpose a factor analysis was done. It was argued that a factor analysis is appropriate since the sample of learners (n=388) is more than ten times the number of items of the selected questions (n=31) (Pietersen & Maree, 2012:222). The following questions under the respective sections as they appear in the questionnaire are applicable: Questions 5 and 6 (Section B), Question 7 (Section C) and Question 8 (Section D). The 31 items or factors also represented the number of variables used in the factor analysis. From these 31 items the number of significant factors was determined by means of their Eigenvalues which were larger than 1 (Pietersen & Maree, 2014b:219). The Eigenvalues of the eight items or factors that were larger than 1 are highlighted in Table 4.16.

Table 4.16: Eigenvalues of factors

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings	
	Total	% of Variance	Cumulative %	Total	% of Variance
1	6.654	21.464	21.464	2.794	9.011
2	2.319	7.481	28.944	2.476	7.986
3	1.844	5.947	34.891	2.457	7.926
4	1.659	5.350	40.242	2.177	7.022
5	1.432	4.618	44.860	2.133	6.880
6	1.220	3.935	48.795	1.922	6.199
7	1.138	3.672	52.467	1.781	5.746
8	1.091	3.519	55.986	1.617	5.216
9	.991	3.196	59.182		
10	.873	2.817	61.998		
11	.845	2.727	64.726		
12	.829	2.674	67.400		
13	.769	2.482	69.882		
14	.739	2.385	72.266		
15	.712	2.296	74.562		
16	.683	2.202	76.764		
17	.669	2.159	78.924		
18	.656	2.116	81.039		

19	.605	1.953	82.993		
20	.579	1.868	84.861		
21	.577	1.861	86.721		
22	.523	1.686	88.407		
23	.513	1.656	90.063		
24	.487	1.572	91.635		
25	.470	1.517	93.151		
26	.437	1.410	94.562		
27	.418	1.349	95.911		
28	.383	1.235	97.146		
29	.339	1.094	98.240		
30	.325	1.050	99.289		
31	.220	.711	100.000		

Four factors which account for 40% of the total variance were identified and extracted as the most important factors as presented in Table 4.17.

Table 4.17: Total variance of the four extracted factors

Component	Initial Eigenvalues		
	Total	% of variance	Cumulative %
1	6.654	21.464	21.464
2	2.319	7.481	28.944
3	1.844	5.947	34.891
4	1.659	5.350	40.242

A rotated component matrix was used to facilitate the interpretation of the identified factors. Factor matrix loadings of less than 0.45 were omitted based on the suggestions of Aitken, et al (2015:158) who maintain that factor loadings of >.71 are considered to be excellent, >.63 very good, >.55 good and >.45 fair while those below are considered to be poor. In Table 4.18 the variables loading on the four extracted factors are highlighted.

Table 4.18: Factor loadings

	Component			
	1	2	3	4
Q5_1		.318	.463	
Q5_2			.398	
Q5_3			.370	
Q5_4			.685	
Q5_5		.348	.554	
Q6_1	.343		.523	
Q6_2	.317		.421	
Q6_3			.596	
Q6_4			.625	
Q7_1	.444			
Q7_2	.467	.358		
Q7_3	.693			
Q7_4	.318	.461		
Q7_5	.558			
Q7_6	.693			
Q7_7	.598			
Q7_8	.428	.360		
Q7_9	.338	.365	.315	
Q7_10		.337	.309	
Q7_11	.508	.347		
Q7_12		.420		
Q8_1		.634		
Q8_2		.393		.348
Q8_3		.558		
Q8_4		.506		
Q8_5		.483		
Q8_6				.604
Q8_7				.843
Q8_8				.838
Q8_9				.667
Q8_10		.329		.454

In the next section, the questions and items that constitute the various factors are considered, the factors are labelled and the results are interpreted.

4.2.3.3.2 Factor 1

The question and items forming Factor 1 are included in Table 4.19. Although all the variables point to particular matters with regard to teacher *competence*, inherent in these matters is the learners' apparent concern about *compassion*. Terms to justify this observation are highlighted in Table 4.19. It can therefore be deduced that Factor 1 could be meaningfully labelled as **competent, compassionate teachers**.

Table 4.19: Questions and items constituting Factor 1

Question/item numbers	Question: <i>Express your opinion regarding the extent to which the statements below reflect your teachers' teaching competence in Technology. My teacher ...</i>
7-2	can demonstrate practical skills related to Technology in a comprehensible manner
7-3	can clarify difficult aspects of the subject sensibly
7-5	is sensitive towards problems experienced by individual learners in the subject
7-6	is able to solve problems experienced by individual learners in the subject
7-7	uses a variety of teaching methods in the subject
7-11	sets realistic assessment tasks in Technology

4.2.3.3.3 Factor 2

The applicable variables that constitute Factor 2 are indicated in Table 4.20. All the variables suggest intended outcomes of Technology as subject. However, when considering the highlighted terms in Table 4.20 more critically, *development* as one of the cornerstones of the intended outcomes emerges. Moreover, since the learner respondents valued these variables as important, it suggests that they can *personally* associate with them. Derived from the mentioned information, it can be concluded that Factor 2 could be appropriately labelled as **personal, developmental value**.

Table 4.20: Questions and items constituting Factor 2

Question/item numbers	Question: <i>Express your opinion regarding the extent to which the statements below reflect your teachers' teaching competence in Technology.</i> <i>My teacher ...</i>
7-4	can relate Technology subject content to real life situations
	Question: <i>Express your opinion regarding the extent to which Technology as subject addresses the statements below.</i> <i>The subject Technology....</i>
8-1	contributes in the development of a technological literate society
8-3	develops learners' creative thinking skills
8-4	develops learners' critical thinking and problem solving skills
8-5	fosters teamwork

4.2.3.3.4 Factor 3

Table 4.21 covers the variables that comprise Factor 3. All the variables allude to *activities* associated with Technology as subject. The highlighted terms in Table 4.21 imply that a direct consequence of activities is *stimulation*, which is regarded as essential in a subject such as Technology by the respondents. For this reason it is believed that Factor 3 could be labelled as ***stimulation***.

Table 4.21: Questions and items constituting Factor 3

Question/item numbers	Question: <i>How often do you engage in any of the following self-study activities to broaden your knowledge and skills regarding Technology as subject?</i>
5-1	Reading hard copy sources such as articles or books
5-4	Attending organised exhibitions related to Technology as subject
5-5	Visiting places or sites of technological importance (e.g. Eskom)
	Question: <i>How often does your teacher promote Technology as subject by...</i>
6-1	organizing in-school displays, presentations or demonstrations
6-3	organizing fieldtrips
6-4	sharing interesting facts regarding the subject or career prospects related to the subject with parents

4.2.3.3.5 Factor 4

Considering the variables in Table 4.22, the highlighted terms denote the *introduction* to subjects in the field of Technology and on matters related to making informed subject choices. If it is argued that *introduction* is realised through the sharing of information, the fourth Factor could be labelled as ***distribution of information***.

Table 4.22: Questions and items constituting Factor 4

Question/item numbers	Question: <i>Express your opinion regarding the extent to which Technology as subject addresses the statements below.</i> <i>The subject Technology....</i>
8-6	introduces learners towards the basics required for the FET subject: Civil Technology
8-7	introduces learners towards the basics required for the FET subject: Mechanical Technology
8-8	introduces learners towards the basics required for the FET subject: Electrical Technology
8-9	introduces learners towards the basics required for the FET subject: Engineering Graphics and Design
8-10	provides learners with relevant knowledge and experiences to take informed decisions about career-oriented subject choices at the end of Grade 9

In summary, the four factors that emerged from the factor analysis based on the selected questions in the learners' questionnaire which strongly point to the determinants affecting Grade 9 learners' selection of subjects in the field of Technology for the FET Phase in the Sedibeng area are:

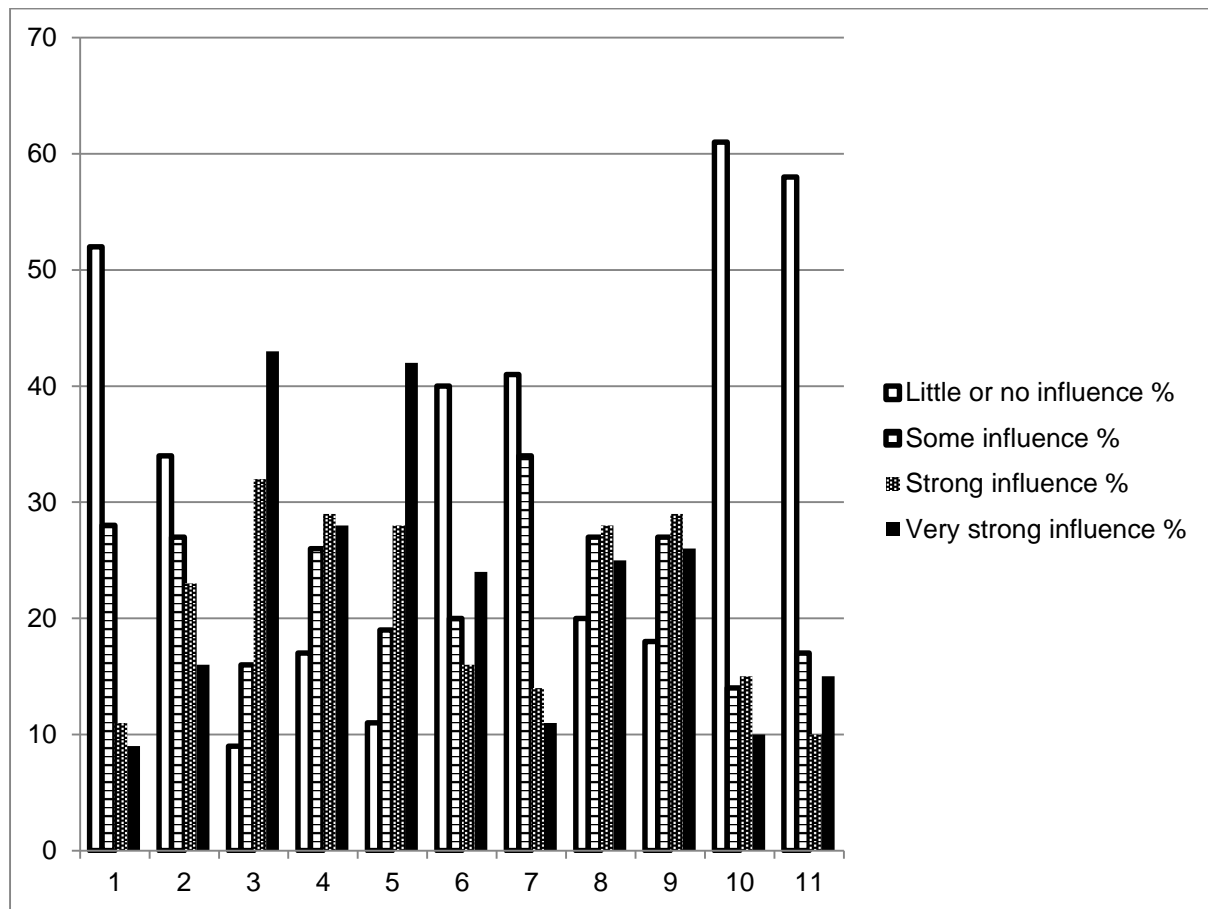
- Factor 1: Competent, compassionate teachers
- Factor 2: Personal, developmental value
- Factor 3: Stimulation
- Factor 4: Distribution of information.

4.2.3.4 Section E: Influences towards the selection of subjects in the field of Technology

Question 9 of the questionnaire required an indication of the possible factors which influence learners to include subjects in the field of Technology in their subject choices. Based on the responses as represented in Figure 4.5, the biggest influence

appears to be competent teachers. 75% of the respondents indicated that they are “strongly” and “very strongly” influenced to select subjects in the field of Technology by the fact that their Technology teachers are good. It is interesting to note that this finding resonates with Factor 1 (competent, compassionate teachers) in 4.2.3.3.2. The second biggest influence is the respondents’ enjoyment of the practical work offered in Technology since 70% of the respondents indicated that they are “strongly” and “very strongly” influenced by this aspect when considering including subjects in the field of Technology in their subject choices. In this case the connection to Factor 2 (personal, developmental value) (*cf.* 4.2.3.3.3) and Factor 3 (stimulation) (*cf.* 4.2.3.3.4) is evident. The enjoyment of the theory of Technology “strongly” and “very strongly” influences 57% of the respondents to include subjects in the field of Technology in their subject choices. This third biggest influence could also be associated with Factor 2 and Factor 3. Schools that offer a limited choice of subjects for the FET phase in the field of Technology as indicated by 55% of the respondents, is the fourth biggest aspect that influences the respondents “strongly” and “very strongly”. Noteworthy is the fact that 53% of the respondents are “strongly” and “very strongly” influenced to select subjects in the field of Technology in terms of their view that Technology is an easy subject. 80% of the respondents indicated that they are “not influenced” or “somewhat influenced” by their parents’ views that it is pointless to include subjects in the field of Technology in their subject choice. 75% admitted that they are “not influenced” or “somewhat influenced” by respectively their friends’ subject choices; that they are compelled to include subjects in the field of Technology though this does not represent their preferred choice, and that although they would like to include it in their subject choice their schools do not offer any subjects in this field. 61% and 60% of the respondents admitted that they are “not influenced” or “somewhat influenced” by respectively their parents’ advice about the usefulness of subjects or their future career prospects in the field of Technology.

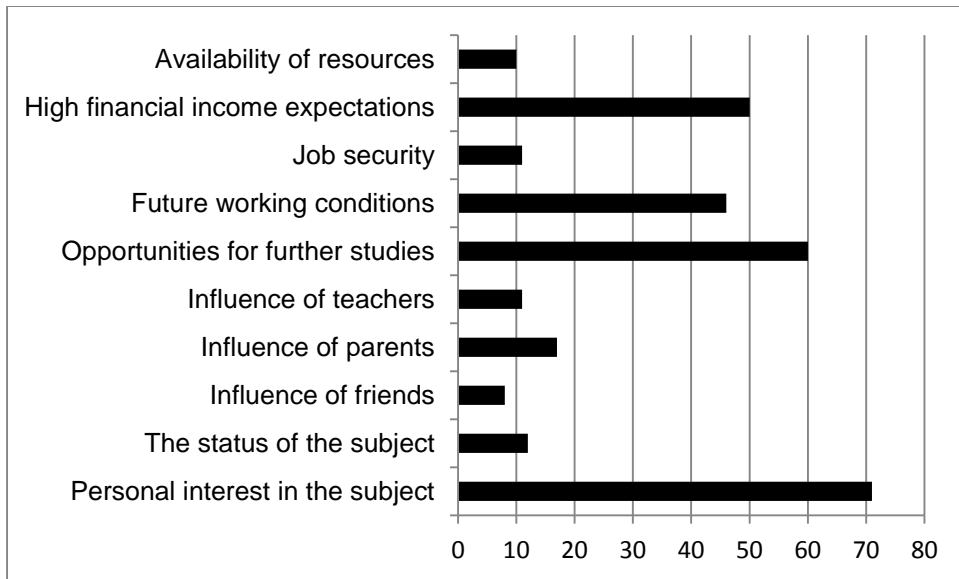
Figure 4.5: Factors influencing the inclusion of Technology in learners' subject choice



4.2.3.5 Section F: Considerations when making subject choices

When required to identify the three most important factors influencing their subject choice from a list of factors (*cf.* Question 10; Figure 4.6), the majority of the sampled learners (71%) highlighted their personal interest in the subject as the most important. Opportunities for further studies were identified as important by 60% of the respondents followed by high financial income expectations (50%) and future working conditions (46%). Interesting is the fact that the influence of parents (17%) is regarded as more important by the respondents than the influences of teachers (11%) and friends (8%). According to the respondents the status of the subject (11%), job security (11%) and available resources (10%) are factors that are apparently less influential when making subject choices. It is thus clear that the respondents rely on their personal interest in the subject by also bearing in mind their future studies and the value of the subject after school, when making subject choices.

Figure 4.6: Most important factors influencing subject choices



4.2.3.6 Preliminary findings from the learners' questionnaire

From the data obtained from the learners' questionnaires, it becomes visible that especially four factors impact on learners' subject choices in the field of Technology. These factors, which could be categorised as central factors are: competent, compassionate teachers, the personal and developmental value of the subject, stimulation and the distribution of information regarding the subject. In addition, it appears as if a number of peripheral factors are also evident. These would include: the range of subjects for the FET phase in the field of Technology offered by schools, the complexity level of subjects in the field of Technology, personal interest in a subject and future prospects offered by a subject.

4.3 COMPARISON BETWEEN TEACHERS' AND LEARNERS' RESULTS

Since Questions 12 to 15 of the teachers' questionnaire corresponded with Questions 5 to 8 of the learners' questionnaire, the researcher believed it would be thought-provoking to draw a comparison between the results of these two sets of findings. From these four questions the four factors emanated from the learners' responses (*cf.* 4.2.2.3). However, the teachers' sample was very small ($n=10$) and differed significantly from the learners' sample ($n=388$). It was therefore important to exercise extreme caution when trying to draw possible comparisons between the teachers' and learners' findings on the identified questions. For this reason a non-

parametric method in the form of the Mann-Whitney test (Leedy & Ormrod, 2005:274; Pietersen & Maree, 2012:225, 233-234) was executed to assess as to whether the scores of these two independent groups on the said questions have a similar ranked distribution. The results after applying the Mann-Whitney test are presented in Table 4.23 below.

Table 4.23: Mann-Whitney test results: comparison between the findings of teachers and learners

Group	N	Mean rank	Z	Statistical significance
Factor 1: Teachers	10	193.15	-2.010	0.044
Factor 1: Learners	388	265.3		
Factor 2: Teachers	10	194.24	-.830	0.407
Factor 2: Learners	388	223.95		
Factor 3: Teachers	10	192.54	-2.674	0.007
Factor 3: Learners	388	288.4		
Factor 4: Teachers	10	193.66	-1.462	0.144
Factor 4: Learners	388	245.95		

Arranged according to the four factors, it appears as if there are no significant differences in the findings derived from the two sets of results in terms of Factors 2 and 4. Factor 1 shows a small significance ($p=.044$) whereas Factor 3 projects a difference ($p=.007$). It can thus be concluded that the personal and developmental value of the subject (Factor 2) and the distribution of information regarding the subject (Factor 4) are highlighted by both groups as determinants affecting Grade 9 learners' selection of subjects in the field of technology for the FET phase while competent, compassionate teachers (Factor 1) and stimulation (Factor 3) are highlighted by the learners.

4.4 QUALITATIVE DATA ANALYSIS AND INTERPRETATION

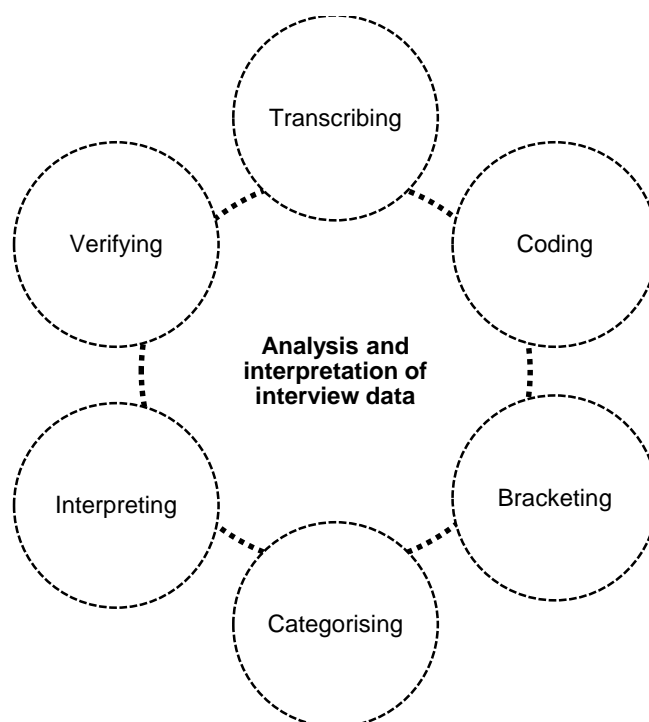
4.4.1 Background information

From the eight purposively identified subject facilitators for Technology education in the Sedibeng area, only three were available to be interviewed. The individual interviews with these research participants were intended to serve an explanatory purpose by refining, explaining or extending (Ivankova et al., 2012:272) the data obtained through the quantitative approach.

4.4.2 Analysis and interpretation of individual interview data

After the interview data were captured by auditory means, it was transcribed verbatim. During transcribing the researcher engaged critically with the data by following the process of coding where the transcribed information was divided into meaningful segments (Plano Clark & Creswell, 2010:281). These meaningful segments were grouped together under *a priori* categories (Nieuwenhuis, 2012c:99,107,109) which were derived from the central matters addressed in the interview questions. This implies that the interview data were approached deductively. To ensure the accuracy and credibility of the deductive approach, the researcher engaged with the data in a constant comparative manner by “bracketing” (Plano Clark & Creswell, 2010:287) his own beliefs, perceptions and experiences which could affect the research results. The procedures followed to analyse the qualitative data were subjected to a peer review (*cf.* 3.8) to ensure the reliability of the results. According to Nieuwenhuis (2012c:99) the aforementioned procedures exemplifies a typical iterative or non-linear process which is depicted in Figure 4.7. The dotted lines indicate that the procedures are inter-related and that they are not executed in a particular order (Schurink, Fouché & De Vos, 2012:403).

Figure 4.7: The iterative process followed to analyse and interpret the interviews



4.4.3 Presentation of the coded interview data

Derived from the responses of the sampled subject facilitators, the raw transcribed data of their interviews reflect the coded accounts for each of the interview questions. The coded data are presented in Tables 4.24 to 4.32 on the following pages.

Table 4.24: Interview responses (Question 1)

Question 1: Rationale for including Technology as subject		
P1	P2	P3
<ul style="list-style-type: none"> • To encourage learners to follow the Engineering field of study 	<ul style="list-style-type: none"> • To produce engineers, technicians and artisans needed in modern society • To develop a technologically literate population for the modern world • It stimulates learners to be innovative • To develop creativity and critical thinking skills • To manage time, materials and resources effectively • To provide opportunities for collaborative learning • To nurture teamwork • To form a solid foundation for FET subjects and for the world of work 	<ul style="list-style-type: none"> • To see Maths, Science and Technology as one entity • To serve as forerunner for Technology subjects in the FET phase • Technology had to replace Industrial arts as it was known up until 2002. Pre 2002 was only for the boys and only for the girls in Standard 6 and 7. Technology had • To replace Industrial Arts and Home Economics and accommodate both boys and girls

Table 4.25: Interview responses (Question 2)

Question 2: Extent to which the rationale was satisfied		
P1	P2	P3
<ul style="list-style-type: none"> • Minimal • At the end of Gr. 9 learners must study more independently • Not all schools offer Technology subjects in the FET phase to learners 	<ul style="list-style-type: none"> • Still misconceptions of what Technology Education really is • A lack of required knowledge and skills and resources still remains a challenge 	<ul style="list-style-type: none"> • The subject Technology haven't served its purpose yet • In most cases Technology is used as a gap filling subject to fill up teachers' timetable • Teachers with no technological background, interest or formal training had to present the subject without having an idea what Technology as subject entails • The lack of teacher continuity from one year to another and from Grade 8 to Grade 9 • A woodworking teacher presenting Technology would present a woodworking like Technology and a Home economics teacher presenting a Home economics like Technology

Table 4.26: Interview responses (Question 3)

Question 3: The quality of Technology teaching in Sedibeng		
P1	P2	P3
<ul style="list-style-type: none"> • 40% • No institutions training Technology teachers • Unqualified Technology teachers is a problem 	<ul style="list-style-type: none"> • Not that good • In most schools that offer Engineering Graphics and Design in the FET phase the quality is very good because sometimes Teachers are teaching across the phases to “groom” the learners • In schools that are not offering skills subjects this remains a challenge 	<ul style="list-style-type: none"> • The Sedibeng district as a whole (D7 and D8) has well trained teachers • Teachers were trained in the Technology field in the Umvuzelelo project of the NWU-Vaal campus. The approximate 150 teachers were trained over a period of 2-3 years and they were well equipped with technical skills

Table 4.27: Interview responses (Question 4)

Question 4: The quality of learner performance in Technology in the primary part of the Senior phase as compared to that of the secondary part of the Senior phase		
P1	P2	P3
<ul style="list-style-type: none"> Learner performance depends a lot on the type of teacher who should be passionate with a good subject and Technology background 	<p>Primary part of the Senior Phase (Grade 7)</p> <ul style="list-style-type: none"> The quality is very good In this phase most of the resources that the learner need must be collected To gain the skills e.g. making and designing skills it must be practically demonstrated in the classroom under the supervision of the educator as small children enjoy learning through play Learner success depends on the educator's approach, the level of knowledge and skills <p>Secondary part of the Senior Phase (Grade 8 and 9)</p> <ul style="list-style-type: none"> Boys seem to excel as compared to girls The skills of boys are well developed Girls don't want to collect materials as requested; they have problems of attitude to demonstrate their skills 	<ul style="list-style-type: none"> If the project is done at home it is usually the parents who take over and build or organize someone to build something for the learner to get good marks It is usually the learners with a less impressive model or project who did it themselves and that gained a lot of hands-on experience Time is managed wrong at schools and this puts teachers and learners under unnecessary stress to complete the curriculum and all the projects on time

Table 4.28: Interview responses (Question 5)

Question 5: The quality and availability of Technology resources in the Sedibeng area		
P1	P2	P3
<ul style="list-style-type: none"> • Schools received toolkits • The lack of passion for the subject, knowledge of the subject and continuity of teachers in teaching Technology create problems because they cannot use the kits for the intended purpose • Toolkits are not enough but serves as a basic resource to show the learner and to provoke interest 	<ul style="list-style-type: none"> • Availability differs from school to school • Schools offering Technical subjects in the FET phase have a lot of resources while schools not offering Technical subjects in the FET phase have no resources like the basic tools needed • Schools don't want to improvise, they always want to buy e.g. some electronic devices can be obtained from old machines • The Department only supplies human resources (teachers) and no other resources specifically for Technology • I have seen only one toolkit and it was given for the subject advisor so that he could conduct a workshop • I only know of Science that got toolkits but not of Technology • The availability of resources would be nice because Teachers would be motivated to find out how these different things work and it would develop interest in Technology 	<ul style="list-style-type: none"> • Every school in the Sedibeng District D7 and D8 received a Technology toolkit that includes all the necessary tools • Most of these toolkits did not end up at the Technology teacher because of the frequent changing in teachers offering Technology • Each toolkit has enough resources to keep a class of 35 learners busy for a given topic • A problem with these toolkits was that everything should be disassembled to be reused in the next class • There were many projects that equipped schools with resources but in most of the cases it was used incorrectly and not for the purpose intended

Table 4.29: Interview responses (Question 6)

Question 6: Challenges associated with Technology as subject		
P1	P2	P3
<ul style="list-style-type: none"> • Resources (financial) • Resources (tools) • Resources (consumables) • Qualified Technology teachers 	<ul style="list-style-type: none"> • There are a lot of challenges • A lack of the required educator knowledge • Teachers' studies did not initially include Technology as part of their course • Teachers don't have any academic background or formal qualification in Technology • Teachers gain most of their knowledge through workshops and Professional Working Groups • Teachers lack drawing skills (graphic communication), electrical skills (electric and electronic control), mechanical skills (mechanical control) • Lack of support at school level since the chain of command (HOD, Deputy Principal and Principal) can't provide assistance • Setting of question papers is a problem • 40% compliance in the moderated papers • Teachers can't formulate higher order questions aimed at application • Most schools do not have textbooks for the teachers or learners • Teachers teaching Technology changes yearly; no the teacher growth in terms of skills and knowledge • Only a few schools comply with the time allocation; especially for practicals 	<ul style="list-style-type: none"> • Passionate Technology teachers • Subject continuity • Funding • Resources

Table 4.30: Interview responses (Question 7)

Question 7: Personal promotion of Technology as subject amongst learners for the FET phase in the Sedibeng area		
P1	P2	P3
<ul style="list-style-type: none"> • Encouraging learners by telling them the importance of the subject Technology in the FET phase • Engaging learners in various projects trying to provoke interest in the subject 	<ul style="list-style-type: none"> • In the Sedibeng East District we have a project for each Grade (7 - 9) • Olympiad for Grade 7 – “scenario” 	<ul style="list-style-type: none"> • In the Gauteng province a career guidance booklet is distributed in August each year to all the Grade 9 learners to tell them what Technology education entails in the FET phase • In Engineer Graphics and Design (EGD) we have pamphlets from the Department of Basic Education that is distributed to Grade 8 and 9 learners across Gauteng telling learners what EGD is all about

Table 4.31: Interview responses (Question 8)

Question 8: Awareness of general promotion of Technology as subject amongst learners in the Sedibeng area		
P1	P2	P3
<ul style="list-style-type: none"> • Various projects • Technology Olympiads • Exhibitions • Quizzes • Smart young minds 	<ul style="list-style-type: none"> • Grade 7 Technology Olympiad • Grade 8 Exhibition • Grade 9 Quiz competition • Grade 8-10 Smart young minds 	<ul style="list-style-type: none"> • Various projects that I know of but still not enough • Smart young minds • Blue IQ • F1 project racing car (stopped because of costs) as well as no continuity of teachers promoting the project

Table 4.32: Interview responses (Question 9)

Question 9: What else can be done to promote Technology as subject?		
P1	P2	P3
<ul style="list-style-type: none"> • More projects • Projects that don't exclude any learners (level playing field) • Cooperation of the private sector • More funding from Government 	<ul style="list-style-type: none"> • Establishing professional working groups (PWGs) • PWGs will serve as places where Teachers will share knowledge and skills that must be transferred to learners • PWGs will result in quality learning • Quality workshops for Technology teachers • Teachers must be allocated with bursaries to study Technology as this will make them more competent to produce engineers, technicians and artisans needed in the modern society and the need to develop a technologically literate population for the modern world 	<ul style="list-style-type: none"> • We will have to change the minds of the learners' parents • The parents decide for the learners • Parents rather see their children in white collar jobs • Parents are looking down on technical qualifications

4.4.4 Identifying *a-priori* categories for interpreting the interview data

The *a-priori* categories originated from the central matters address in each of the interview questions. The nine interview questions were associated with, and clustered according to the categories as indicated in Table 4.33.

Table 4.33: The *a-priori* categories according to the interview questions

Interview questions	<i>A-priori</i> categories
What do you think was the rationale of the Department of Basic Education for including Technology as subject in the school curriculum?	Rationale
To what extent, do you think, did the implementation of Technology as subject satisfied this rationale?	
How would you rate the quality of Technology teaching in the Sedibeng area? (Motivate?)	Teaching
How would you rate the quality of learner performance in Technology in the primary part of the Senior phase as compared to that of the secondary part of the Senior phase?	Learner performance
How would you rate the quality and availability of Technology resources in the Sedibeng area?	Resources
What, in your opinion, are the challenges associated with Technology as subject?	Challenges
What do you as subject facilitator do to promote the selection of Technology as subject amongst learners for the FET phase in the Sedibeng area?	Promotion
What is done, that you are aware of, to promote Technology as subject amongst learners in the Sedibeng area?	
What else can be done to promote Technology as subject?	

4.4.5 Interpretation of individual interviews

Matching the mentioned categories as identified in Table 4.33, the coded interview data are interpreted below.

4.4.5.1 Rationale (Questions 1 & 2) (Tables 24 & 25)

The three participants focused on different but related matters when responding to Question 1. Participant 1 (P1) focused on the prospects for future studying or career opportunities. Although this view was shared by Participant 2 (P2), the ultimate objectives of Technology as subject were also mentioned. Participant 3 (P3) ascribed the rationale for Technology as subject to the changes in the curriculum and the preparation of learners for Technology subjects in the FET phase. On the participants' reaction towards the extent the rationale for implementing Technology as subject was satisfied (Question 2), all three the participants reacted negatively by using phrases such as "minimal" (P1), "still misconceptions" (P2) and "haven't served its purpose yet" (P3). According to the participants' views it is thus clear that few or none of the intentions with Technology as subject were realised as yet.

4.4.5.2 Teaching (Question 3) (Table 26)

Two of the participants (P1, P2) revealed that the quality of Technology teaching is not good. However, P2 admitted that the teaching quality of Engineering Graphics and Design in the FET phase is "very good". This could possibly be ascribed to the fact that the majority of teachers teaching in the field of Technology have experience in teaching the subject (*cf.* 4.2.2.1.3) and that most of the schools offer the subject (*cf.* 4.2.3.2.4). Although P3 expressed the opinion that the teachers teaching Technology in the Sedibeng area are well trained, the same participant contradicts himself with the response given in Question 2. In this instance it was indicated that 'teachers with no technological background, interest or formal training' offer the subject and that there is no "teacher continuity". Derived from the participants' views it appears as if they have little confidence in the teaching competence of teachers teaching Technology as subject. However, the teaching quality of Engineering Graphics and Design in the FET phase is regarded as being good.

4.4.5.3 Learner performance (Question 4) (Table 27)

P1 asserted that learner performance is dependent on a competent teacher who is also "passionate" while P2 echoed that learners' success hinges on "the level of knowledge and skills" of the teacher. The same participant suggested that Grade 7 learners perform better than Grade 8 and 9 learners in subjects in the field of

Technology, while boys tend to outperform girls in the higher grades. P3 expressed the concern that learner performance in Grade 7 is dependent on assistance from home due to time constraints experienced in schools. From the participants' responses it can be concluded that although the quality of learner performance could be influenced by the support received at home, teacher competence and passion are more likely to be influential.

4.4.5.4 Resources (Question 5) (Table 28)

All three participants indicated that schools receive toolkits in which the basic hand tools are included as well as some consumables to assist teachers in teaching Technology, but that the availability of these and the number issued differ from school to school (P1, P2, P3). Due to “a lack of passion, knowledge and continuity of teachers” (P1, P3) the available toolkits at schools are not fully utilised. Moreover, teachers “do not know how to improvise” when sources are lacking (P2). While schools offering Technical subjects do have other resources than the toolkits, these are not always available at schools not offering Technical subjects (P2). In instances where schools got donations, these resources were used “incorrectly and not for the purposes intended” (P3). From the participants' answers it can be deduced that the quality and availability of resources not only differ from school to school, but that its utilization is somewhat hampered by teachers' knowledge, skills and enthusiasm.

4.4.5.5 Challenges (Question 6) (Table 29)

Resources and “qualified” (P1), “passionate” (P3) teachers are the most challenging factors identified by all three research participants. Although P2 elaborated on the lack of competence amongst teachers teaching Technology as subject, it was also mentioned that the allocation of time to the subject is problematic. This resonates with the perception of P3 expressed in Question 2: “Technology is used as a gap filling subject to fill up teachers' timetable”. This could possibly also be related to the apparent low value attached to Technology teaching by school managements (P2) of which “teacher continuity” appears to be a symptom (*cf.* P3: Question 2; P1: Question 5; P3: Question 5; P3: Question 6). Therefore, it can be concluded that teacher competence, resources and the value attached to Technology teaching by school managements are the most prominent challenges associated with Technology as subject.

4.4.5.6 Promotion (Questions 7, 8 & 9) (Tables 30, 31 & 32)

Engagement with learners (P1), projects (P2) and printed material (P3) are the noticeable ways of how the sampled subject facilitators promote Technology as subject (Question 7). In response to Question 8 the sampled participants showed awareness of various projects such as ‘smart young minds’ (an annual school competition with the strategic objective of stimulating interest among learners in the fields of Mathematics, Science, Technology and Entrepreneurship), (P1, P2, P3), Olympiads (P1, P2) exhibitions (P1, P2) and quizzes (P1, P2) to promote Technology as subject. When asked what else can be done to promote Technology as subject, two of the participants mentioned more affordable projects, cooperation with the private sector (P1) and more effort to involve parents (P3). Participant 2 expressed a strong opinion that Technology as subject could be further promoted by recruiting, training and stimulating teachers to perform their task better. In this regard “professional working groups”, “quality workshops” and the “allocation of bursaries” were explicitly mentioned (P2).

4.4.5.7 Preliminary findings from the subject facilitators’ interviews

From the results obtained from the qualitative part of the study, the sampled Technology subject facilitators expressed their concerns about four particular issues concerning the success of Technology education in the Sedibeng area. These include:

- the exhausting efforts to realise the rationale behind the implementation of Technology;
- a concern about teacher competence, passion and continuity in teaching Technology as subject;
- the quality and availability of resources, and
- the apparent underestimated value attached to Technology as subject by school managements.

4.5 DEDUCTIONS FROM THE CONNECTED QUANTITATIVE AND QUALITATIVE FINDINGS

By following a sequential explanatory mixed methods strategy of inquiry (*cf.* 1.5.2.2.2 & 3.5) the researcher intended to use the qualitative findings “to help clarify ... refine, explain and extend” (Ivankova et al., 2012:272) the quantitative results. To achieve

the aforementioned it seems appropriate to connect the findings obtained from the two sets of data.

In as far as the quantitative part of the study is concerned, it was evident that four factors emerged from the results obtained from the learners' questionnaire as determinants affecting Grade 9 learners' selection of subjects in the field of technology for the FET phase. These factors were competent, compassionate teachers, the personal and developmental value of the subject, stimulation and the distribution of information regarding the subject (*cf.* 4.2.3.3). To a greater or lesser extent these factors were verified by the results obtained from the teachers' questionnaires (*cf.* 4.3). In addition to these four factors, the learners' results also revealed a number of peripheral factors. These included: the range of subjects for the FET phase in the field of Technology offered by schools, the complexity level of subjects in the field of Technology, personal interest in a subject and future prospects offered by a subject.

Related to what were identified as possible factors impacting on learners' subject choice from the literature, the following links are observed:

- Learners' ability and personality (*cf.* 2.4.2.3 (i)) relates to the complexity level of subject in the field of Technology.
- Learners' experiences in school (*cf.* 2.4.2.3 (ii)), school type and location (*cf.* 2.4.2.4.1) and availability of resources (*cf.* 2.4.2.4.6) relate to stimulation, the distribution of information regarding the subject and the range of subjects for the FET phase in the field of Technology offered by schools.
- Influence of teachers (*cf.* 2.4.2.4.5) relates to competent, compassionate teachers.
- Self-efficacy and personal interest in a subject (*cf.* 2.4.2.4.2) relates to personal interest in a subject.
- Opportunities for further studies and future career paths (*cf.* 2.4.2.4.7) relates to the future prospects offered by a subject.

With reference to the qualitative part of the study, four particular issues concerning the success of Technology education in the Sedibeng area were highlighted by the participating Technology subject facilitators. These included: the exhausting efforts

to realise the rationale behind the implementation of Technology; a concern about teacher competence, passion and continuity in teaching Technology as subject; the quality and availability of resources, and the apparent underestimated value attached to Technology as subject by school managements.

By using the qualitative findings for clarifying, refining, explaining and extending the quantitative findings, the following are discovered:

- In as much as the choice of subjects in the field of Technology relies on competent, passionate teachers, there is doubt that the current teaching corps in the Sedibeng area satisfies these expectations.
- Whereas the personal and developmental value and the distribution of information regarding the subject contribute towards learners' decisions in making subject choices, convincing evidence to justify the value and therefore the selection of subjects in the field of Technology, has apparently not as yet filtered through to school managements and the broader society.
- Although stimulation in a subject contributes towards its attractiveness to be selected when making subject choices, the quality and availability of resources could be seen as an obstruction to this end.

4.6 CONCLUSION

In this chapter the data obtained by means of the teachers and learners' questionnaire were analysed and interpreted to form the quantitative part of the study. Subsequently, the qualitative part of the study was addressed by means of the analysis and interpretation of the interview data obtained from the subject facilitators. The results that emerged from the above were connected to generate convincing findings.

In the following chapter an overview of the study will be provided, the most pertinent findings will be highlighted and recommendations, based on the findings, will be made.

CHAPTER 5

SUMMARY, FINDINGS AND RECOMMENDATIONS

5.1 INTRODUCTION

The purpose of this sequential explanatory mixed methods study was to appraise the determinants affecting Grade 9 learners' selection of subjects in the field of Technology for the FET Phase in the Sedibeng area. Complementing this overall purpose, secondary research questions and objectives were formulated to be operationalised through a literature and empirical study.

The current chapter will serve as conclusion of the study by providing an overview in which the gathered information will be related to the respective secondary questions, objectives and the central purpose of the study. After an account is provided of the most conspicuous findings from the literature review and empirical research, recommendations on the findings will be made. Possible deficiencies in the study will be identified and recommendations for further research will be discussed.

5.2 OVERVIEW OF THE STUDY

By considering the purpose and objectives of the study, the respective chapters of the study can be summarised as outlined in the subsequent subsections.

5.2.1 Chapter one

This chapter aimed to introduce the study by means of an orientation. The study was introduced and justified by reasoning that despite the high unemployment rate and the scarce skills shortages experienced in South Africa, learners show little interest in selecting subjects in the field of Technology for their FET school careers (*cf.* 1.1). This inspired the researcher to appraise the determinants affecting Grade 9 learners' selection of subjects in the field of Technology for the FET Phase in the Sedibeng area (*cf.* 1.2). Appropriate research questions and objectives were then formulated to guide the study (*cf.* 1.3). Key phrases and concepts were identified to serve as conceptual framework on which the study could be theoretically founded (*cf.* 1.4). An outline of the research methodology was given (*cf.* 1.5); delimitations of the study were considered (*cf.* 1.6); the significance and possible contribution of the

study were highlighted (*cf.* 1.7) and possible challenges of the study were stated (*cf.* 1.8). The chapter concluded by providing a provisional chapter division (*cf.* 1.9).

5.2.2 Chapter two

By studying the literature and relevant documents of the Department of Basic Education, the following three secondary questions and their concomitant objectives which directed this chapter were realised.

Secondary research questions:

- What is the rationale for, and value of Technology education as part of the South African school curriculum?
- What is the nature of Technology as field of study in the South African school curriculum?
- What influences learners' subject choices?

Objectives:

- To determine the rationale for, and value of Technology education as part of the South African school curriculum.
- To clarify the nature of Technology as field of study in the South African school curriculum.
- To establish the factors which influence learners' subject choices.

By studying the literature and relevant documents of the Department of Basic Education, these objectives were realised in the following ways. Technology education was defined and its introduction in the South African school curriculum was considered to address the rationale and value of Technology education (*cf.* 2.2). This was followed by a discussion on how Technology education is infused in the school curriculum (*cf.* 2.3). The notion of subject choice was also attended to (*cf.* 2.4) by identifying possible factors impacting on learners' subject choice. The chapter was concluded by a concise outline of subject choices in the field of Technology (*cf.* 2.5).

5.2.3 Chapter three

This chapter provided an overview of the empirical study in terms of the processes and procedures which were followed to gather information relevant to the following secondary research questions and overall purpose of the study:

- What are the understanding and attitudes of GET teachers teaching Technology, regarding the subject?
- What are the perceptions of learners in the GET Phase, about the subject Technology?
- What are the concerns of Technology subject facilitators regarding the viability and sustainability of Technology as field of study?

In this chapter it was specified that the study is embedded in the Pragmatist paradigm (*cf.* 3.3) and that it followed an explanatory mixed methods research design (*cf.* 3.4). The strategy of inquiry was justified as sequential explanatory mixed methods, comprising of a survey and a phenomenology study for the quantitative and qualitative parts respectively (*cf.* 3.5). The population, sampling and sample were discussed (*cf.* 3.6) after which the data collection methods were identified and their administration explained (*cf.* 3.7). The quality criteria (*cf.* 3.8), pilot study (*cf.* 3.9) and role of the researcher (*cf.* 3.10) as applicable to the study were respectively discussed. A clarification on how ethical considerations guided the study was provided (*cf.* 3. 11) and the chapter was concluded by explaining the data collection process visually (*cf.* 3.12).

5.2.4 Chapter four

After justifying the empirical processes and procedures in the previous chapter, chapter four focused on the analysis and interpretation of the data collected to address the primary research question in which the applicable secondary research questions (*cf.* 5.2.3) were infused. The data analysis and interpretations were sequenced in the order which was followed during the data collection process (*cf.* 3.12). In line with this order, a detailed discussion was done on the quantitative data analysis and interpretation of information obtained through the questionnaires to teachers and learners (*cf.* 4.2) by also drawing a comparison between these two sets of results (*cf.* 4.3). This represented the first part of the empirical study. Subsequently, information obtained from the subject facilitators were analysed and interpreted for the qualitative or second part of the study (*cf.* 4.4). The chapter was concluded by inferences that arose from connecting the quantitative and qualitative findings (*cf.* 4.5).

5.3 FINDINGS OF THE RESEARCH

The literature as well as the empirical study contributed towards the attainment of the study's overall purpose. In this section the most significant findings derived from these two sources are highlighted.

5.3.1 Summary of findings originating from the literature study

The intention of the literature study was to provide a theoretical framework on which the empirical research could be based. Therefore, the literature study and the conclusions drawn from it are important since it can enlighten the empirical findings.

For the purpose of the study, the literature study was guided by three secondary research questions (*cf.* 1.3.2 and 5.2.2). Emanating from the literature study the following findings have direct bearing on the purpose of the research and are worth mentioning:

- In line with how it is defined (*cf.* 2.2.1) Technology education was introduced in the South African school curriculum to serve long term and personal goals.
 - In terms of long term goals it is envisaged that Technology education will provide relevant education to the needs of society; make provision for continuity by introducing the subject also in the lower grades; contribute towards workforce requirements and ensure a technologically literate society (*cf.* 2.2.2.1 and 2.2.2.2).
 - In as far as personal goals are concerned it is envisioned that Technology education would stimulate creative and critical thinking, encourage effective time and material resources management and provide opportunities for collaboration.
- Technology education in the FET phase could be defined as discipline specific Technology education and training with a view towards a specific range of jobs or employment possibilities for school leavers (*cf.* 2.3.3).
- A range of factors impact on learners' subject choice. Amongst others, these include learners' ability and personality, learners' experiences in school, external inputs (e.g. learners' background knowledge and experience of the subject, environmental exposure to the subject, acquaintance with the subject through significant role models, advice from relatives, and scholarly inducements based on performance in the subject), the value attached by

society to a specific subject (*cf.* 2.4.2.3), school type and location, self-efficacy and personal interest, influence of peers and teachers, availability of resources and future prospects offered by the subject (*cf.* 2.4.2.4)

5.3.2 Summary of findings originating from the empirical research

Answering the primary research question (*cf.* 1.3.1) is the focus of this study. However, the following three secondary research questions (*cf.* 1.3.2) were embedded in the primary research question:

- What are the understanding and attitudes of GET teachers teaching Technology, regarding the subject?
- What are the perceptions of learners in the GET phase, about the subject Technology?
- What are the concerns of Technology subject facilitators regarding the viability and sustainability of Technology as field of study?

It is therefore necessary to contemplate the consolidated findings that emerged from the research results related to these three secondary research questions. Regardless of the fact that the teacher sample was too small to yield any significant results (*cf.* 4.2.2.6), relevant results that transpired from their responses are nevertheless noted.

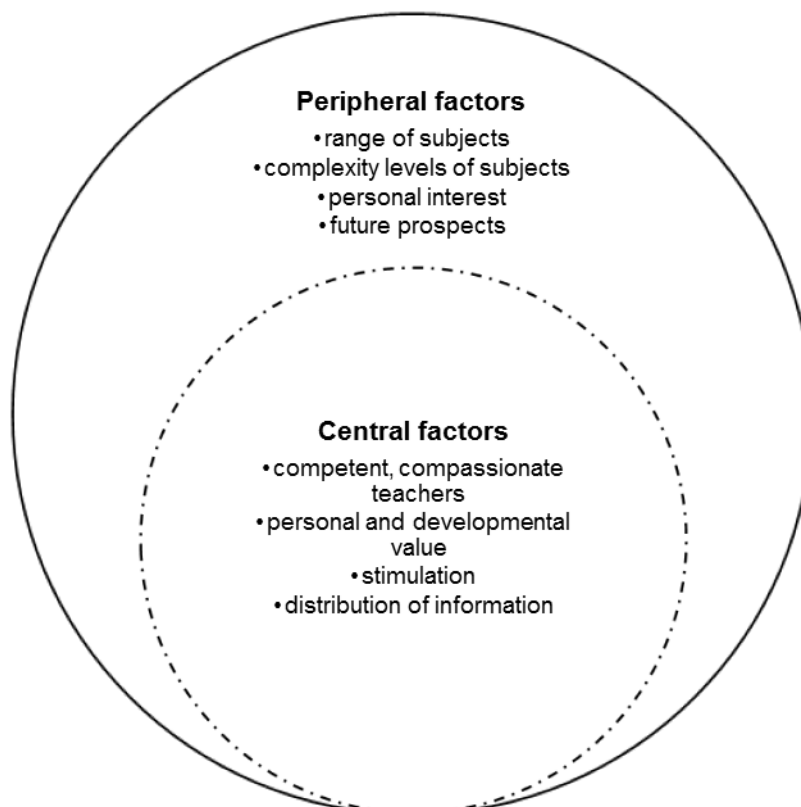
- Although the teachers were of the opinion that they are competent to teach Technology (*cf.* 4.2.2.3) their sources of additional information regarding the subject is limited to their colleagues (*cf.* 4.2.2.2.1) while their engagement with self-study activities (*cf.* 4.2.2.2.2) is also limited to participation in subject groups and hard copy sources. However, the teachers acknowledge the value of Technology as subject (*cf.* 4.2.2.4). From the sampled teachers' responses it appears as if their understanding and attitudes regarding Technology can be rated as moderate to good.
- In general, it appears as if the sampled learners have positive perceptions about Technology as subject. The learners indicated that the subject holds personal and developmental value with which they can relate (*cf.* 4.2.3.3.3) and that they find the activities in the subject stimulating (*cf.* 4.2.3.3.4). Although the majority of the learners' schools only offer Engineering Graphics

and Design as FET subject (*cf.* 4.2.3.2.4), they expressed the opinion that Technology as subject sufficiently introduced them to all the available Technology subjects for the FET phase (*cf.* 4.2.3.3.5).

- Technology subject facilitators are concerned that the rationale behind the introduction of Technology as subject has not yet been realised (*cf.* 4.4.5.1), that teacher continuity, passion and competence create cause staffing problems (*cf.* 4.4.5.2), that the quality and availability of resources (*cf.* 4.4.5.4) and the value attached to the subject by school management teams (*cf.* 4.4.5.5) inhibit the potential of the subject.

To resolve the primary research question, the determinants affecting Grade 9 learners' selection of subjects in the field of Technology for the FET Phase in the Sedibeng area as it emerged from this study, are presented in Figure 5.1.

Figure 5.1: Determinants affecting Grade 9 learners' selection of subjects in the field of Technology for the FET Phase



Derived from the information portrayed in Figure 5.1 it is evident that central factors and peripheral factors can be distinguished. However, the dotted line indicates that

although two sets of factors can be distinguished they should not be seen as totally detached from each other. The central factors include: competent, compassionate teachers, the personal and developmental value of the subject, stimulation and distribution of information regarding the subject. The peripheral factors encompass the range of subjects offered in the field of Technology, the complexity levels of subjects, personal interest and the future prospects offered by the subject. There appears to be some correlation of these factors with identified factors from the literature (*cf.* 4.5).

5.4 RECOMMENDATIONS

Derived from the findings discussed in 5.3, the researcher recommends the following:

- The Department of Basic Education should seriously consider the employment of competent, compassionate and skilful teachers who are specifically assigned for Technology education in each school to enhance the image of the subject.
- The Department of Basic Education should organise more intensive, subject oriented workshops or short courses to improve teachers' practical skills and make sure that all teachers know what to do and how it should be done.
- Taking the above mentioned into account, measures to ensure teacher continuity should also be considered.
- School Management Teams should be re-oriented about the importance of Technology as subject as well as other subjects in the field of Technology.
- Principals and HOD's must encourage good communication between the parties responsible for subjects in the field of Technology (e.g. teachers and subject facilitators), particularly when it is about resources.
- In case resources are not available, teachers should improvise to ensure that learners are stimulated.
- Schools and teachers in the field of Technology should do constant marketing to promote the attraction of Technology subjects in the FET phase. This could be done by exposing learners to vibrant, interesting experiences, creating relevance of the subject for day to day living, keeping open communication with the private sector, inviting influential guest speakers,

organising field trips to various relevant industries (e.g. Eskom, Mittal), establishing cross-curricular links with other subjects such as Mathematics and Science.

- Closer cooperation between officials of the Department of Basic Education, Technology teachers and higher education institutions should be established to ensure the appropriateness of pre-service and in-service teacher education programmes.
- There is immense potential for the improvement of subject and career guidance at schools which should be explored in order to provide quality guidance to learners.

5.5 LIMITATIONS OF THE STUDY

Since possible weaknesses may be identified in any research, research results should always be treated as conditional. In the case of this study, the researcher became aware of some limitations that need to be mentioned.

- The research was confined to the Sedibeng area and conducted in only two districts. Consequently, generalizations of the findings or assumptions that the findings are relevant to all schools in the province or country would be risky.
- More teacher and subject facilitator participants could have enhanced the findings of the research.
- After the interviews it was realised that the researcher's prompting skills could be improved to enable the collection of richer data.
- During the analysis of the data it was realised that the involvement of parents, School Management Teams and teachers responsible for subject guidance, could have enriched the research data.

5.6 RECOMMENDATIONS FOR FURTHER RESEARCH

This study provoked other possible researchable matters in the researcher's mind. Therefore, the following recommendations for further research are applicable:

- Research to confirm as to whether the results obtained from this research will concur to a larger sample could be done.

- The focus of this research (determinants impacting on subject choice), could be replicated to other subjects and organising fields.
- Research could be done to establish the perceptions of specific communities (e.g. rural and urban, the private sector) regarding Technology as subject.
- Evaluative research could be done on the curricula and quality of Technology teacher education at South African universities.
- Research to explore how subject choice in the field of Technology impact on learners' further studies and career choices can be carried out.
- The value of the subject Life skills with reference to subject and career choice could be determined.
- An appraisal of the availability and quality of resources for Technology education could be assumed.

5.7 FINAL CONCLUSION

In the final analysis it is evident that a wide range of factors impact on learners' decisions to select particular subjects for the FET phase. Although specific factors were identified and isolated for the purpose of this study, it remains an open question as to whether these are peculiar to a certain geographical area, a certain subject field or a certain generation of learners. However, the fact of the matter is that the importance of the selection of subjects at the end of Grade 9 and the vital role of especially subject teachers in learners' decision making should not be underestimated.

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GAUTENG PROVINCE

Department: Education
REPUBLIC OF SOUTH AFRICA

For administrative use:
Reference no. D2014/202

GDE RESEARCH APPROVAL LETTER

Date:	14 August 2013
Validity of Research Approval:	14 August 2013 to 20 September 2013
Name of Researcher:	Kruger J.A.
Address of Researcher:	118 Drakensberg Street
	Sonlandpark
	Vereeniging
	1930
Telephone Number:	016 910 3065 / 083 733 2485
Fax Number:	016 910 3078
Email address:	Jan.Kruger@nwu.ac.za
Research Topic:	An appraisal of determinants affecting Grade 9 learners' selection / choice of Technology subjects for the FET phase in the Sedibeng area
Number and type of schools:	SEVENTEEN Secondary Schools
District/s/HO	Sedibeng East and Sedibeng West

Re: Approval in Respect of Request to Conduct Research

This letter serves to indicate that approval is hereby granted to the above-mentioned researcher to proceed with research in respect of the study indicated above. The onus rests with the researcher to negotiate appropriate and relevant time schedules with the school/s and/or offices involved to conduct the research. A separate copy of this letter must be presented to both the School (both Principal and SGB) and the District/Head Office Senior Manager confirming that permission has been granted for the research to be conducted.

The following conditions apply to GDE research. The researcher may proceed with the

1

Making education a societal priority

Office of the Director: Knowledge Management and Research

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NORTH-WEST UNIVERSITY
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PO Box 1174, Vanderbijlpark
South Africa, 1900

30 October 2013

Dear Prof. K Lombard,

ETHICS CLEARANCE APPROVED

This letter serves to indicate that your ethics application was approved in principle by the VTC Ethics Sub-Committee for Basic and Educational Sciences of the Faculty of Humanities:

Faculty application number:	FH-BR-2013-0016
Project Leader:	Prof K Lombard
Applicant:	JA Kruger
Project title:	An appraisal of determinants affecting Grade 9 learners' selection of subjects in the field of Technology for the FET Phase in the Sedibeng area.
Meeting date:	21 October 2013

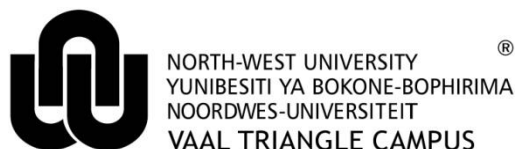
Kindly remember to forward outstanding documents (if applicable) to the chairperson of the ethics sub-committee. In the case of post graduate research, please remember to submit your proposal to Ms. D. Claasens (Ext: 103441) for approval and title registration by the Faculty Board.

The VTC Ethics Sub-Committee wishes you well with your research project.

Yours sincerely

Chrizanne van Eeden

Chair: VTC Ethics Sub-Committee: Basic and Educational Sciences.



PO Box 1174, Vanderbijlpark
South Africa, 1900

Tel: 016 910-3111
Fax: 016 910-3116
Web: <http://www.nwu.ac.za>

The Principal

.....
.....
.....

Dear Sir/Madam

Re: Research at your school

I am currently busy with my MEd studies in Education at the above-mentioned institution and would like to include teachers teaching Grade 9 Technology as well as their Grade 9 learners at your school in the empirical research of my study. The research concerns an appraisal of determinants affecting Grade 9 learners' selection of subjects in the field of Technology for the FET Phase in the Sedibeng area. Approval has already been granted by The Gauteng Department of Basic Education to continue with the research (See attached letter).

Could you please confirm as to whether your school would be available for the completion of questionnaires by the mentioned teachers and learners in order to achieve the aim of the research? Once your permission is given, arrangements will be made with the concerned parties to complete the questionnaires at an appropriate time as to not interfere with your school's teaching and learning activities.

Feedback will be provided to the school after the research has been completed. For any additional information or questions, please feel free to contact me or my supervisor at the numbers below.

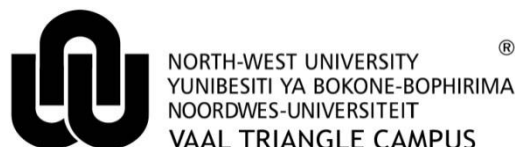
Yours sincerely.

JA Kruger (Student nr. 21568960)

Contact details:

JA Kruger: 0837332485

Prof BJJ Lombard 016 910 3067



INFORMED CONSENT (Technology teachers)

Dear Grade 9 Technology teacher

I am currently busy with research for my MEd-degree and I need your assistance to provide me with information to complete the study successfully. This document will provide you with information regarding the project and what your involvement will entail. If you feel comfortable with the contents of the explanation I will appreciate it if you could sign the section indicating your consent to take part in the study.

Kindly note the following before you give consent to participate in the project.

The aim of the research is to appraise the determinants affecting Grade 9 learners' selection of subjects in the field of Technology for the FET Phase in the Sedibeng area. The research results could assist to identify the weaknesses and strengths in the field of Technology Education which, as a consequence, could help to improve the quality of teaching and learning as well as the status of subjects in this knowledge field and lead to more learners choosing subjects in this field.

With the assistance of your school principal you were identified to participate in the research. However, your permission is required to take part in the research.

Your participation will involve the completion of a questionnaire during a pre-arranged session after school hours. The completion of the questionnaire will not take longer than 20 minutes of your time. Please note that the intention of the questionnaire is NOT to evaluate **your** teaching, but to gather information-rich research information which will help to inform the aim of the study.

Participation in the research is not compulsory and you may withdraw at any time should, you feel uncomfortable. Be assured that your inputs will be used for research purposes only and that your participation will be treated confidentially.

There are no direct benefits for taking part in the study. However, the findings of the research may in future assist to enhance the quality of teaching and the profile of subjects in the field of Technology.

The research is conducted by a Masters student, JA Kruger, under the supervision of Prof BJJ Lombard from the School of Educational Sciences, North-West University (Vaal Triangle Campus). If you have any questions or queries you can contact Prof Lombard at 016 910 3067 (work) or myself at 087332485.

CONSENT:

I..... (full name) have read and understand the nature of my participation in the project and agree to participate.

Signature:.....

Date:.....



INFORMED CONSENT (Technology subject facilitators)

Dear Technology subject facilitator

I am currently busy with research for my MEd-degree and I need your assistance to provide me with information to complete the study successfully. This document will provide you with information regarding the project and what your involvement will entail. If you feel comfortable with the contents of the explanation I will appreciate it if you could sign the section indicating your consent to take part in the study.

Kindly note the following before you give assent to participate in the project.

The aim of the research is to appraise the determinants affecting Grade 9 learners' selection of subjects in the field of Technology for the FET Phase in the Sedibeng area. The research results could assist to identify the weaknesses and strengths in the field of Technology Education which, as a consequence, could help to improve the quality of teaching and learning as well as the status of subjects in this knowledge field and lead to more learners choosing subjects in this field.

Since the study will be conducted in the Sedibeng area you were identified to participate in the research. However, your permission is required to take part in the research.

Your participation will involve the participation in an individual interview during a pre-arranged session. The interview will not take longer than 30 minutes of your time. Please note that the intention of the interview is NOT to evaluate **your** performance as Technology subject facilitator, but to gather information-rich research information which will help to inform the aim of the study.

Participation in the research is not compulsory and you may withdraw at any time should you feel uncomfortable. Be assured that your inputs will be used for research purposes only and that your participation will be treated anonymously and confidentially.

There are no direct benefits for taking part in the study. However, the findings of the research may in future assist to enhance the quality of teaching and the profile of subjects in the field of Technology.

The research is conducted by a Masters student, JA Kruger, under the supervision of Prof BJJ Lombard from the School of Educational Sciences, North-West University (Vaal Triangle Campus). If you have any questions or queries you can contact Prof Lombard at 016 910 3067 (work) or myself at 087332485.

CONSENT:

I..... (Full name) have read and understand the nature of my participation in the project and agree to voluntary participate.

Signature:.....

Date:.....



INFORMED ASSENT (Grade 9 Technology learners)

Dear Grade 9 Technology learner

I am currently busy with research for my MEd-degree and I need your assistance to provide me with information to complete the study successfully. This document will provide you with information regarding the project and what your involvement will entail. If you feel comfortable with the contents of the explanation I will appreciate it if you and your parents could sign the section indicating your assent to take part in the study.

Kindly note the following before you give assent to participate in the project.

The aim of the research is to appraise the determinants affecting Grade 9 learners' selection of subjects in the field of Technology for the FET Phase in the Sedibeng area. The research results could assist to identify the weaknesses and strengths in the field of Technology Education which, as a consequence, could help to improve the quality of teaching and learning as well as the status of subjects in this knowledge field and lead to more learners choosing subjects in this field.

With the assistance of your school principal you were identified to participate in the research. However, your and your parents' permission is required to take part in the research.

Your participation will involve the completion of a questionnaire during a pre-arranged session after school hours. The completion of the questionnaire will not take longer than 20 minutes of your time. Please note that the intention of the questionnaire is NOT to evaluate **your** performance in Technology, but to gather information-rich research information which will help to inform the aim of the study.

Participation in the research is not compulsory and you may withdraw at any time should you feel uncomfortable. Be assured that your inputs will be used for research purposes only and that your participation will be treated anonymously and confidentially.

There are no direct benefits for taking part in the study. However, the findings of the research may in future assist to enhance the quality of teaching and the profile of subjects in the field of Technology.

The research is conducted by a Masters student, JA Kruger, under the supervision of Prof BJJ Lombard from the School of Educational Sciences, North-West University (Vaal Triangle Campus). If you have any questions or queries you can contact Prof Lombard at 016 910 3067 (work) or myself at 087332485.

ASSENT:

[Learner] I..... (Full name) have read and understand the nature of my participation in the project and agree to voluntary participate.

Signature:.....

Date:.....

[Parent] I..... (Full name) have read and understand the nature of my child's participation in the project and take note of his/her voluntary participation.

Signature:.....

Date:.....

**North-West University
Vaal triangle Campus**

Teacher questionnaire for M.Ed. studies on the topic: *An appraisal of determinants affecting Grade 9 learners' selection of Technology subjects for the FET phase in the Sedibeng area.* To be completed by teachers who teach Grade 9 Technology in the Sedibeng area.

➤ **Note:**

Please follow the instructions carefully and complete ALL items by placing an **X** in the box of your choice or by filling in the information in the appropriate spaces.

Section A: Biographical information

1. Gender

Male	1
Female	2

2. Age

20 - 25 years	1
26 - 35 years	2
36 - 45 years	3
46 - 55 years	4
56 - 60 years	5
60+ years	6

3. Total years of teaching experience

Less than 5 years	1
5 - 10 years	2
11 - 20 years	3
21 - 30 years	4
31 years or more	5

4. Number of years teaching experience in Technology in the GET phase

Less than 3 years	1
4 - 10 years	2
11 - 15 years	3
16 years or more	4

5. Number of years teaching experience in the field of Technology in the FET phase

Less than 3 years	1
4 - 10 years	2
11 - 15 years	3
16 years or more	4

6. Highest teacher education qualification

Certificate	1
Diploma	2
3 year degree plus Diploma	3
4 year degree	4
Honours degree	5
Master's degree	6
PhD	7
Other (please specify)	8

7. Highest qualification in the field of Technology

Grade 12 or lower	1
N1-N2	2
N3-N4	3
N5-N6	4
Artisanship	5
1 st year higher education qualification	6
2 nd year higher education qualification	7
3 rd year higher education qualification	8
Honours degree	9
Master's degree	10
PhD degree	11

8. Type of school in which you currently teach

Ex Model C school	1
Township school	2

9. Current post level

Teacher	1
Head of Department	2
Deputy Principal	3
Principal	4

10. I have teaching experience in the following FET subject(s) in the field of Technology: (Mark all applicable)

Engineering Graphics and Design	1
Civil Technology	2
Electrical Technology	3
Mechanical Technology	4
None of the above mentioned	5

Section B: Awareness related to Technology as subject**11. How often do you receive any additional information regarding Technology as subject from the sources mentioned below?**

Source	Almost Never	Now and then	Regularly	Almost always
District Subject facilitator	1	2	3	4
Responsible HOD	1	2	3	4
Sources within the Department of Basic Education	1	2	3	4
Sources within the education sector (e.g. FET Colleges, Higher Education Institutions)	1	2	3	4
Sources within the private sector (e.g. Industries, Mining houses)	1	2	3	4
Colleagues responsible for teaching Technology at school level	1	2	3	4
Other stakeholders not mentioned above	1	2	3	4

12. How often do you engage in any of the following self-study activities to broaden your competence regarding Technology as subject?

Activities	Almost never	Now and then	Regularly	Almost always
Reading hard copy sources such as articles or books	1	2	3	4
Reading electronic sources on the internet	1	2	3	4
Participation in discussion groups / subject groups	1	2	3	4
Attending organised exhibitions related to Technology as subject	1	2	3	4
Visiting places or sites of technological importance (e.g. Eskom)	1	2	3	4

13. To what extent are you involved in the promotion of Technology as subject?

I actively promote Technology as subject beyond formal teaching and learning situations by	Very little	Somewhat	Often	Almost always
organizing in-school displays, presentations or demonstrations	1	2	3	4
providing subject guidance	1	2	3	4
organizing fieldtrips	1	2	3	4
sharing interesting facts regarding the subject or career prospects related to the subject with parents	1	2	3	4

Section C: Technology teachers' views regarding their teaching competence

14. Express your opinion regarding the extent to which the statements below reflect your teaching competence in Technology.

I...	Very little	Some what	Often	Nearly always
can explain Technology subject content effortlessly	1	2	3	4
can demonstrate practical skills related to Technology in a comprehensible manner	1	2	3	4
can clarify difficult aspects of the subject sensibly	1	2	3	4
can relate Technology subject content to real life situations	1	2	3	4
am sensitive towards problems experienced by individual learners in the subject	1	2	3	4
can solve problems experienced by individual learners in the subject	1	2	3	4
can vary my teaching methods in the subject	1	2	3	4
can structure interesting learning activities in the subject	1	2	3	4
can stimulate learners' creative thinking in the subject	1	2	3	4
can stimulate learners' critical thinking and problem solving skills in the subject	1	2	3	4
can set assessment tasks in Technology with confidence	1	2	3	4
can provide learners with guidance concerning their Technology subject choices for the FET phase	1	2	3	4

Section D: Views regarding Technology as subject

15. Express your opinion regarding the extent to which Technology as subject addresses the statements below.

The subject Technology....	Very little	Some what	Often	Nearly always
contributes in the development of a technological literate society	1	2	3	4
stimulates learners to be innovative	1	2	3	4
develops learners' creative thinking skills	1	2	3	4
develops learners' critical thinking and problem solving skills	1	2	3	4
fosters teamwork	1	2	3	4
introduces learners' towards the basics required for the FET subject: Civil Technology	1	2	3	4
introduces learners' towards the basics required for the FET subject: Mechanical Technology	1	2	3	4
introduces learners' towards the basics required for the FET subject: Electrical Technology	1	2	3	4
introduces learners' towards the basics required for the FET subject: Engineering Graphics and Design	1	2	3	4
provides learners with relevant knowledge and experiences to take informed decisions about career-oriented subject choices at the end of Grade 9	1	2	3	4

Section E: Technology teachers' views regarding challenges in Technology

16. Express your opinion regarding the extent to which the statements below reflect the challenges impacting on the popularity of the subject Technology.

The following challenges impact on the popularity of Technology:	Very little	Some what	Often	Nearly always
Quality of Technology teacher education programs	1	2	3	4
Teachers' general Technology knowledge	1	2	3	4
Teachers' attitudes towards the subject Technology	1	2	3	4
Learners' attitudes towards the subject Technology	1	2	3	4
Parents' attitudes towards the subject Technology	1	2	3	4
The availability of technology resources within schools	1	2	3	4

**North-West University
Vaal triangle Campus**

Learner questionnaire for M.Ed. studies on the topic: *An appraisal of determinants affecting Grade 9 learners' selection/choice of Technology subjects for the FET phase in the Sedibeng area.* To be completed by Grade 9 Technology learners in the Sedibeng area.

➤ **Note:**

Please follow the instructions carefully and complete ALL items by placing an **X** in the box of your choice or by filling in the information in the appropriate spaces.

Section A: Biographical information

1. Gender

Male	1
Female	2

2. Grade 9 history

This is my 1 st year in Grade 9	1
I am repeating Grade 9	2

3. Type of school which you currently attending

Ex Model C school	1
Township school	2

4. Please indicate which of the following FET subject(s) in the field of Technology is/are offered at your school

Subject	Offered
Engineering Graphics and Design	1
Civil Technology	2
Electrical Technology	3
Mechanical Technology	4
None of the above mentioned	5

Section B: Awareness related to Technology as subject

5. How often do you engage in any of the following activities to broaden your knowledge and skills regarding Technology as subject?

Activities	Almost never	Now and then	Regularly	Almost always
Reading hard copy sources such as articles or books	1	2	3	4
Reading electronic sources on the internet	1	2	3	4
Participation in discussion groups / subject groups	1	2	3	4
Attending organised exhibitions related to Technology as subject	1	2	3	4
Visiting places or sites of technological importance (e.g. Eskom)	1	2	3	4

6. How often do your school's Technology teachers promote Technology as subject among Grade 9 learners by...?

	Almost Never	Now and then	Regularly	Almost always
organizing in-school displays, presentations or demonstrations	1	2	3	4
providing subject guidance	1	2	3	4
organizing fieldtrips	1	2	3	4
sharing interesting facts regarding the subject or career prospects related to the subject with parents	1	2	3	4

Section C: Technology teachers' teaching competence

7. Express your opinion regarding the extent to which the statements below reflect your teachers' teaching of Technology.

My teacher...	Almost never	Now and then	Regularly	Almost always
can explain Technology subject content effortlessly	1	2	3	4
can demonstrate practical skills related to Technology in a comprehensible manner	1	2	3	4
can clarify difficult aspects of the subject sensibly	1	2	3	4
can relate Technology subject content to real life situations	1	2	3	4
is sensitive towards problems experienced by individual learners in the subject	1	2	3	4
is able to solve problems experienced by individual learners in the subject	1	2	3	4
uses a variety of teaching methods in the subject	1	2	3	4
structures interesting learning activities in the subject	1	2	3	4
stimulates my creative thinking in the subject	1	2	3	4
Stimulates my critical thinking and problem solving skills in the subject	1	2	3	4
sets realistic assessment tasks in Technology	1	2	3	4
provides me with guidance concerning Technology subject choices for the FET phase	1	2	3	4

Section D: Views regarding Technology as subject

8. Express your opinion regarding the extent to which Technology as subject addresses the statements below.

The subject Technology....	Almost never	Now and then	Regularly	Almost always
contributes in the development of a technological literate society	1	2	3	4
stimulates learners to be innovative	1	2	3	4
develops learners' creative thinking skills	1	2	3	4
develops learners' critical thinking and problem solving skills	1	2	3	4
fosters teamwork	1	2	3	4
introduces learners' towards the basics required for the FET subject: Civil Technology	1	2	3	4
introduces learners' towards the basics required for the FET subject: Mechanical Technology	1	2	3	4
introduces learners' towards the basics required for the FET subject: Electrical Technology	1	2	3	4
introduces learners' towards the basics required for the FET subject: Engineering Graphics and Design	1	2	3	4
provides learners with relevant knowledge and experiences to take informed decisions about career-oriented subject choices at the end of Grade 9	1	2	3	4

Section E: Attitudes towards the selection of subjects in the field of Technology

9. To what extent will each of the following factors influence you to include Technology in your subject choice?

Statement	Little or no influence	Some influence	Strong influence	Very strong influence
My parents argue that the inclusion of subjects in the field of Technology for my FET subject choice is pointless	1	2	3	4
My parents argue that the inclusion of subjects in the field of Technology in my subject choice for the FET phase would be useful	1	2	3	4
My Technology teacher is good	1	2	3	4
I enjoy the theory of Technology,	1	2	3	4
I enjoy the practical work of Technology	1	2	3	4
I want to follow a career in the field of technology	1	2	3	4
My friends are all thinking of including subjects in the field of Technology	1	2	3	4
Technology is an easy subject	1	2	3	4
My school offers a limited choice of subjects for the FET phase	1	2	3	4
I am compelled to include the Technology subjects offered, even though it is not my first choice	1	2	3	4
I would like to take Technology subjects in the FET phase, but my school does not present any.	1	2	3	4

Section F: Considerations when making subject choices

10. Mark the THREE most important factors that influence you when making subject choices.

Personal interest in the subject	
The status of the subject	
Influence of friends	
Influence of parents	
Influence of teachers	
Opportunities for further studies	
Future working conditions	
Job security	
High financial income expectations	
Availability of resources	

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Interview questions for M.Ed. studies on the topic: *An appraisal of determinants affecting Grade 9 learners' selection/choice of Technology subjects for the FET phase in the Sedibeng area.* Questions to be used to conduct interviews with Technology subject facilitators of the Sedibeng area.

Questions

1. What do you think was the rationale of the Department of Basic Education for including Technology as subject in the school curriculum?
2. To what extent, do you think, did the implementation of Technology as subject satisfied this rationale?
3. How would you rate the quality of Technology teaching in the Sedibeng area? (Motivate?)
4. How would you rate the quality of learner performance in Technology in the primary part of the Senior phase as compared to that of the secondary part of the Senior phase?
5. How would you rate the quality and availability of Technology resources in the Sedibeng area?
6. What, in your opinion, are the challenges associated with Technology as subject?
7. What do you as subject facilitator do to promote the selection of Technology as subject amongst learners for the FET phase in the Sedibeng area?
8. What is done, that you are aware of, to promote Technology as subject amongst learners in the Sedibeng area?
9. What else can be done to promote Technology as subject?