Module analysis: Preparing pre-service teachers' for educational technology integration in their teaching practice

by

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Declaration

I declare that the dissertation/thesis, which I hereby submit for the degree Bed: Computer Integrated Education at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at this or any other tertiary institution."

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Z.Cassim

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Dedication

I dedicate this thesis to my beloved granny who stood by me, and served as a guiding light. Without her prayers, none of this would have been possible.

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Abstract

The rapid growth of technology undoubtedly has an impact on the education system and on the way knowledge is imparted to students. Teachers need to have sufficient knowledge and skills to integrate technology in a lesson. A challenge which pre-service teachers face is not having sufficient knowledge and skills to integrate technology in their teaching practice. This is due to their lack of exposure to electronic resources as well as skills and opportunities to experiment hands-on with educational technology. This study is a module analysis, regarding the preparation of pre-service teachers' for educational technology integration in their teaching practice, at a university. Data was collected through an open ended survey which students had to answer based on their experiences of the module as well as a focus group interview conducted with the lecturers of the module regarding the management of the module. The study is based on the model, Synthesis of Qualitative Data: Preparing pre-service teachers for technology use, utilising the proposals of Jo Tondeur and Johan van Braak. The model states the various factors which need to be taken into consideration when designing a training plan for preparing pre-service teachers for technology use in the classroom. These factors include authentic experience, feedback, role model, reflection, instructional design, collaboration, training staff, access to resources, technology planning and leadership and cooperation within/between institutions. Each of these factors was reviewed, and premises were identified. The results demonstrated that for these factors to be successful, the premises need to be considered. The premises include teaching strategies, peer assessment, resources available, student learning, lifelong learners, technology challenges and learning about technology integration among others. The themes of the conceptual framework paired with the premises were utilized to establish guidelines. These guidelines were be split into two sections, namely; planning a module and preparing preservice teachers for technology use. These guidelines may be adapted to apply to other modules.

Key Terms:

Pre-service teacher, SQD model, Technology integration.

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This is to confirm that the proposal titled "Module analysis: Preparing pre-service teachers' for technology integration in their teaching practice" by Zaheera Cassim has been proof read and edited by me for language usage.

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Kind regards

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1. CHAPTER ONE: GENERAL ORIENTATION

1.1 INTRODUCTION

It is believed that teachers need to find new and innovative ways to intrigue their students. This can be done with the help of technology as it allows teachers to enhance their lessons by using various materials such as videos, images, e-resources etc. It is likely that student learning is most effective when content and pedagogy capture the learner's interest (Pilli & Admiraal, 2017).

With technology having an impact on education, it is important to train future teachers how technology could be integrated into lessons. Research done by Han et al. (2017) shows that by providing students with the opportunity for observation (i.e. seeing how technology is used in the classroom) and practicing technology integration in the classroom, pre-service teachers' intentions to integrate technology into their own teaching increase (Han et al., 2017; Zhao & Frank, 2003). Tondeur et al. (2012) draws our attention to observation being a motivating factor for pre-service student teachers when integrating technology in the classroom. Even though observation is a motivating factor, it is "helpful but not sufficient".

Along with the growth of technology and its integration within an educational setting, Tondeur et al. (2016) is of the opinion that teachers do not have sufficient knowledge or skills to model or teach pre-service student teachers how to integrate technology in the classroom. It is said that there is a lack of "technology knowledge and skills, technology supported pedagogical knowledge and skills and technology related classroom management knowledge and skills" among teachers. It could be that the lack of this knowledge and skills causes a barrier for effective technology integration to take place (Hew & Brush, 2007).

The growth of technology is aligned with integrating technology into classroom practices (Abbitt, 2011). Russel (2003) and Tondeur et al. (2012) state that a gap exists between what pre-service teachers are taught regarding technology integration and how teachers use technology in the classroom. This study aims to explore how pre-service teachers could be supported regarding technology integration within their teaching practice. This will be done by analysing a module

which was previously developed and taught regarding technology integration in the classroom as well as its application within the design of an intervention.

1.2 BACKGROUND

The research examines a general education module at the Faculty of Education in a residential University. This module was developed to prepare pre-service teachers to integrate technology when designing interventions. The purpose of this module was not only to develop an understanding of the theory behind technological integration but also to enable students to apply it.

The focus of the module is on the integration of technology in education, and the preparation of 21st-century skills within the e-learning environment. This module was designed to assist students in building an understanding of the role technology plays in an educational environment and to apply this in their teaching practice. This module is the only one of its kind which the faculty of education offers to students with the focus being on technology integration within education. However, students do have the option of furthering their knowledge regarding technology integration in fundamental methodology modules.

The purpose of the module is for students to be able to identify, evaluate and apply various aspects of technology in teaching to support the development of educational resources; 21st-century skills; and responsible use of technology in their teaching practice.

The module consisted of six topics. These topics support each other whereby students learnt about the availability of resources, planning for teaching with resources, creating resources and various teaching strategies which can be used to integrate technology in the classroom. Various ways of using technology as an assessment tool in the classroom are also taught and demonstrated to learners. The following concept map illustrates the various topics.

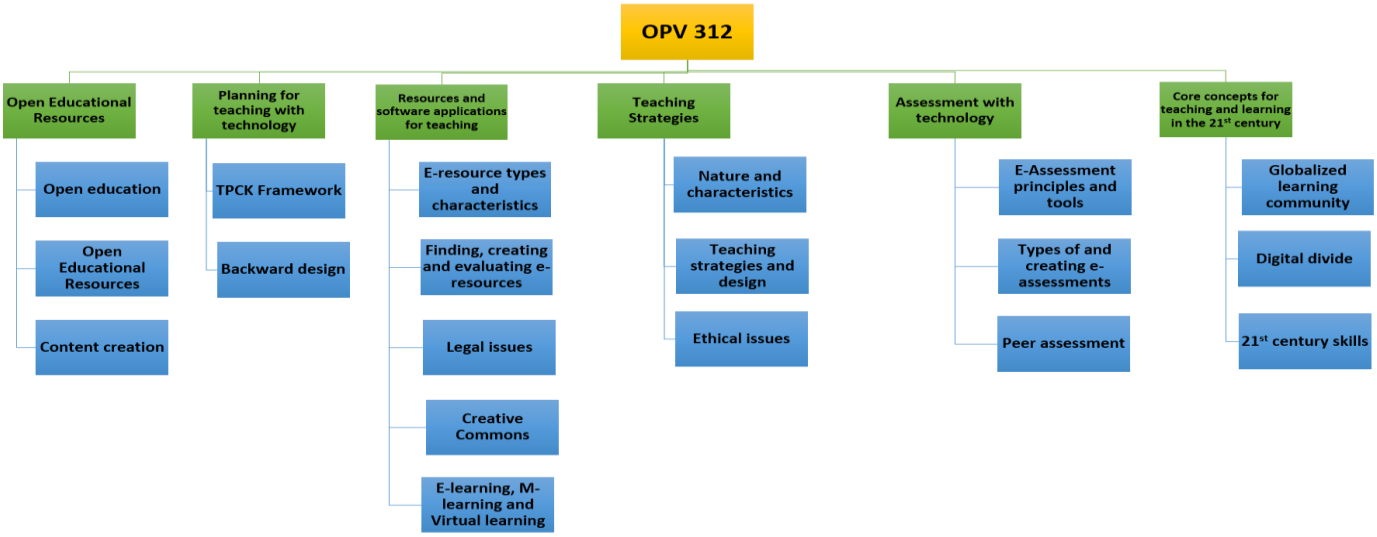


Figure 1: Concept map illustrating the various topics taught during the module

The module assessments included informal interactive assignments during face-to-face teaching; an individual online peer-assessed assignment; and a formal examination. The individual assignment required students to design a learner-centred e-resource that supported interactive teaching and learning. Additionally, students had to state the various teaching strategies used if the resource were to be integrated into a lesson as well as apply their knowledge regarding planning for teaching with technology.

While the module was being taught, students received support during the face-to-face classes; tutor support sessions; and received online content and support on the Learning Management System of the University. The tutor support sessions were held four times a week in the computer laboratories at the university. These support sessions were voluntary. This research aims to critically analyse one cycle of the module, presented during 2017, focusing specifically on supporting student teachers to design learner-centred e-resources for teaching with technology.

1.3 PROBLEM STATEMENT

The new generation of teachers is faced with the challenge of integrating technology in the classroom (Tondeur et al., 2016). A key aspect of the success of technology integration is the knowledge and skills which need to be imparted to pre-service student teachers. This should be done during their undergraduate studies.

1.3.1 AVAILABILITY OF RESOURCES

With the availability of the Internet, various resources can be accessed quickly and easily. The accessibility of resources is essential in the enhancement of teaching and learning. However, the vast amount of resources available for teachers are overwhelming. These could include videos, images, podcasts, e-resources, e-books and worksheets. The variety of materials available could support students because learning is effective when the content and pedagogy capture the learner's interest (Pilli & Admiraal, 2017). Many freely available resources are open-source material that can be used and adapted.

Along with the growth of Open Educational Resources available, there is increasing concern about the quality assurance of these resources. With a large number of available resources, teachers find difficulty in establishing what constitutes or qualifies as a good resource and what does not (Hylén, 2006).

1.3.2 SUPPORT AND TRAINING FROM THE UNIVERSITY

Previously qualified teachers are not always exposed to the vast amount of resources available online, hence they do not have the necessary knowledge and skills to assist pre-service student teachers to integrate technology in their classrooms. Universities, being the training institution for pre-service teachers, should ensure that students leave with sufficient knowledge to ensure technology integration in their classrooms. The university needs to ensure that various support elements are put in place to support these pre-service student teachers to be successful in their classrooms one day (Teo et al., 2008). Central to the discussion of training regarding technology in education, Russell et al. (2003, p. 298) explain that "teacher preparation and training to use education technology is a key factor to consider when examining their use of computers and the internet for instructional purposes"

Instructional technology should be taught to demonstrate the technology as a means of enhancement for a lesson. This will result in pre-service teachers acquiring skills and eventually, having opportunities to experiment hands-on with different forms of technology (Marino et al., 2009). It is said that Teacher Training Institutions (TTI) do not adequately prepare pre-service teachers to use technology in the classroom. This, however, could be done by providing pre-service with more and appropriate experience and knowledge (Russell et al., 2003).

It is believed that opportunities to experiment hands-on with different technologies will increase the self-efficacy beliefs of pre-service teachers, which will ultimately affect their intention of using technology in the classroom (Han et al., 2017; Hew & Brush, 2007(Han et al., 2017, Hew and Brush, 2007).

1.4 RATIONALE

With the growth of technology integration and the endless amount of resources available to adapt and to create Internet resources, it is important to teach pre-service student teachers how to use and create these resources for effective teaching. This study aims to explore how pre-service student teachers could be encouraged to design good quality e-resources, which could be integrated into their teaching. Various support elements were made available to students during the course of the module. Challenges experienced will be explored to see how pre-service teachers can be prepared to integrate technology in their classrooms one day.

1.5 PURPOSE STATEMENT

The purpose of this study is to develop guidelines for future reference with regard to how pre-service student teachers could be supported to design good quality e-resources, which could be integrated into their teaching.

The researcher will critically investigate the support structure and various other elements of the module. These challenges can be reviewed and taken into consideration when planning future modules.

1.6 RESEARCH QUESTIONS

The primary research question of this study is as follows:

How can preservice teachers be prepared for technology use in their own teaching practice?

The secondary questions are:

1. How do lecturers view their role in preparing preservice teachers for technology use?
2. How do students experience the implementation of technology use in their own teaching practice?

1.7 TECHNOLOGY INTEGRATION

Technology integration has been studied by many researchers. There are various defining factors which are crucial for technology integration to be a success. Among these factors, having sufficient knowledge as well as the display of confidence when considering integration in the classroom were deemed important (Abbitt, 2011). This can be achieved through exposure and experience. The more exposure and experience pre-service teachers have with technology integration, the better equipped they would be when implementing technology practices in their classroom. Authors explain that a gap exists between what pre-service teachers are taught regarding technology integration and how teachers use technology in the classroom. As a result, pre-service teachers feel that they are not effectively equipped with sufficient knowledge to use technology in their classrooms (Tondeur et al., 2012, Russell et al., 2003)

Although the pre-service and newly qualified teachers are more exposed to and comfortable with using technology daily, they require training to integrate technology effectively into their own classrooms. The focus of the training should be on how technology integration should take place during formal teaching (Russell et al., 2003)

The lack of knowledge regarding technology integration in the classroom for pre-service student teachers remains a problem. When in the classroom, the mentor teachers decide whether or not integration with technology will take place. If

integration does take place, the pre-service teacher will be given the opportunity to learn how critical the integration of technology in the classroom is. Han et al. (2017) explain, the more experience a pre-service teacher has regarding the integration of technology in the classroom, the more likely that pre-service teacher will implement its use in his/her classroom one day.

Promoting technology integration in the classroom is a rather complex process, especially when trying to integrate it with the curriculum of a TTI. Only once the technology is well infused within the curriculum, allowing pre-service teachers to understand and experience technology, will they understand its pedagogical value in the classroom (Tondeur et al., 2016). This could be achieved by providing them with experience and knowledge on how to integrate technology (Russell et al., 2003). Opportunities to use technology in their teaching should also be provided to these pre-service teachers (Teo et al., 2008).

With the rapid growth of technology, the new generation of teachers is more often faced with the challenge of integrating technology in the classroom than teachers who have graduated in the past. Education has revolutionised when it comes to content delivery and integration of technology with it (Krish & Zabidi, 2017).

This places pressure on TTI to include technology in their curriculum. TTIs are expected to train pre-service teachers on how to design assessments and enhance digital learning experiences for the 21st-century learner. Studies have shown that despite introducing a course on the integration of technology in the classroom, technology is still underutilised by pre-service teachers and only a handful of these students can use technology in “diverse and flexible ways” (Tondeur et al., 2016). Marino et al. (2009) suggest that the Technological Pedagogical Content Knowledge model (TPCK model) should be used as a framework to develop the knowledge, skills and propensities of pre-service teachers to support the integration of technology.

1.8 THEORETICAL UNDERPINNINGS

The theoretical underpinnings of the model which the study will be based on, resonates the Eco systematic theory of Bronfenbrenner. The theory displays the characteristics of an individual which play an influential role in the development of an individual. These characteristics have the ability to "affect the direction and power of proximal processes through the life course" (Bronfenbrenner and Morris, 2007). The Eco systematic theory displays the ecology of a child's environment as a "multi-layered set of nested and interconnected environmental systems". These multi-layered sets are arranged in the sequence of proximity of the child, distal influence to the child and indirect influence on the child. (Mc Guckin and Minton, 2014). The model which this study is be based on is analogous to the Eco systematic theory in the sense where the idea of Bronfenbrenner's multi-layered set is arranged and applied in the situation of preparing pre-service teachers for technology use.

The model on which the study is based is the Synthesis of Qualitative Data model-Preparing pre-service student teachers for technology use (SQD model). The SQD model indicates the focal points which should be taken into consideration when designing a training plan for pre-service teachers for the integration of technology in the classroom. This model could be used as an instrument "to measure pre-service teachers' perception of the extent to which the experience, the support and training needed to integrate technology in their educational practices". The SQD model is a self-reporting instrument. The reason behind the development of this model is to show how each of the points on the model is related in the convolution of the model. Once the model was introduced, the assessment needed to be done to see to what extent these strategies were being implemented and integrated by TTIs (Tondeur et al., 2016). The SQD model is illustrated in Figure 2.

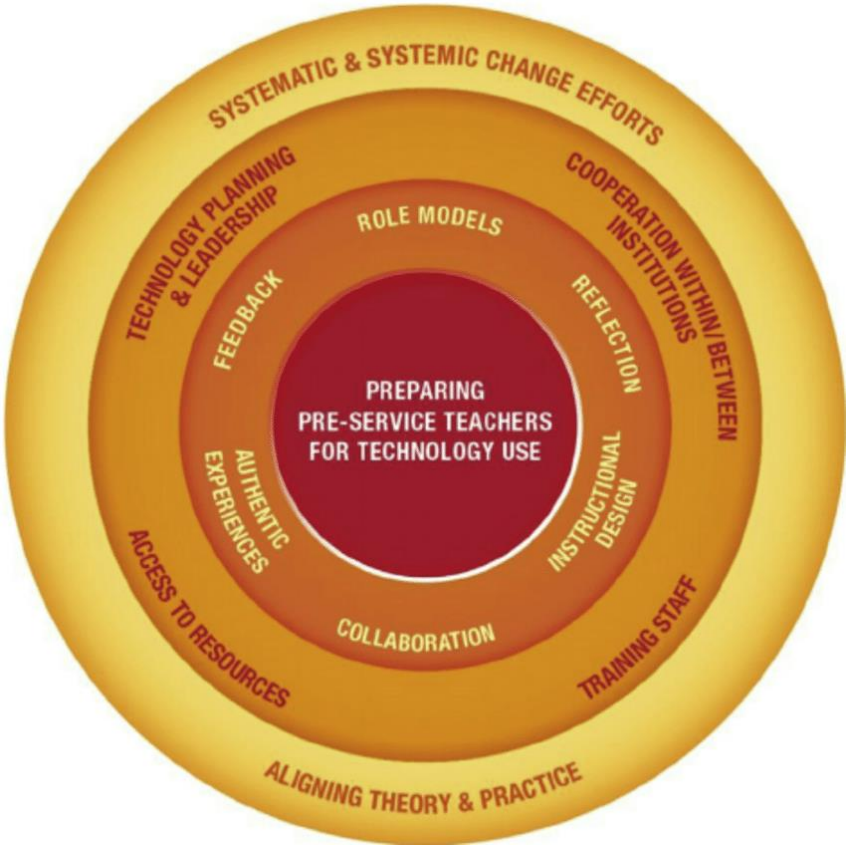


Figure 2: The SQD model

Figure 2 illustrates the SQD model. The model is divided into three parts, i.e. macro, meso and micro. The macro layer is the outer most circle, referring to external factors which cannot be directly controlled by the lecturers, such as the Department of Education, policies etc. The meso-layer, which is the second circle, refers to the institution where training takes place and the environment it creates. The third circle in the model, the micro circle, refers to the specific module where these student teachers are prepared for teaching with technology (Tondeur et al., 2016).

1.9 CONCEPTUAL FRAMEWORK

The study is related to the micro and meso-section of the conceptual framework, as shown in Figure 3. The meso-part (i.e. the red circle) refers to the factors which influence pre-service student teachers on an institutional level, while the micro part refers to the factors within the specific module where student teachers are prepared for their teaching practice.

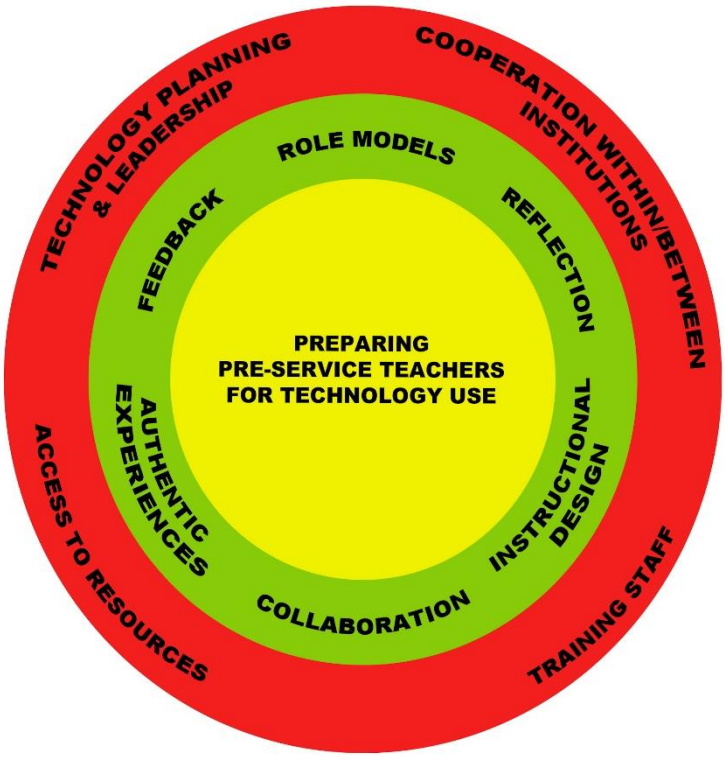


Figure 3: The SQD model as adapted for this study

Table 1 depicts the elements of the conceptual framework, along with possible areas where these are applied at the University, where the study takes place.

Table 1: The elements of the conceptual framework as applied at the University

Key theme	How the theme is integrated into this study
Technology planning and leadership	The Information Technology Services (ITS) Committee of the university provides the various hardware and software components needed for effective teaching and learning to take place. Education innovation is a unit at the university which encourages and supports lecturers in the integration of technology in education. The Deputy Vice-Chancellor Academic supports and encourages the integration of technology in education.
Cooperation within or between institutions	This refers to cooperation between different entities in the University, as well as between different Universities and other institutions to support technology integration.
Training staff/ Staff development	What the university does as an institution to keep lecturers up to date regarding educational technology. Additionally, this theme also relates to how the university supports this development of knowledge.
Access to resources	This refers to the hardware and software resources available in the University to support the integration of technology in teaching, such as access to the Internet, Wi-Fi and the Learning Management System.
Instructional design	There are various teaching strategies and theories which are implemented by the module coordinator and other lecturers to support the integration of technology and teaching.
Authentic experiences	An authentic experience comes in the form of learning through example or via demonstration, whereby students can see how resources can be utilised as well partake in the demonstration of these resources.
Collaboration	Collaboration is important among students and among students and lecturers. It provides opportunities to share ideas and concerns and participate when necessary. This includes the face-to-face classes as well as the Learning Management System
Feedback	Feedback assists students and provides insight regarding what they can change or improvise on. As for the lecturers of the module, they can use this feedback as a form of guidance regarding the design of the module.
Reflection	Reflection among students as well as lecturers is important. It allows one to review the effectiveness of one's skills and embrace change if necessary. Students can reflect on their learning, while lecturers can use reflection and see how the module can be adapted for future use.
Role models	Lecturers and subject experts would act as role models for they are conveying content knowledge and skills to students.

1.10 RESEARCH METHODOLOGY

The research onion, created by Mark Saunders, supports the researcher in decision-making during planning for research (Saunders & Tosey, 2013).

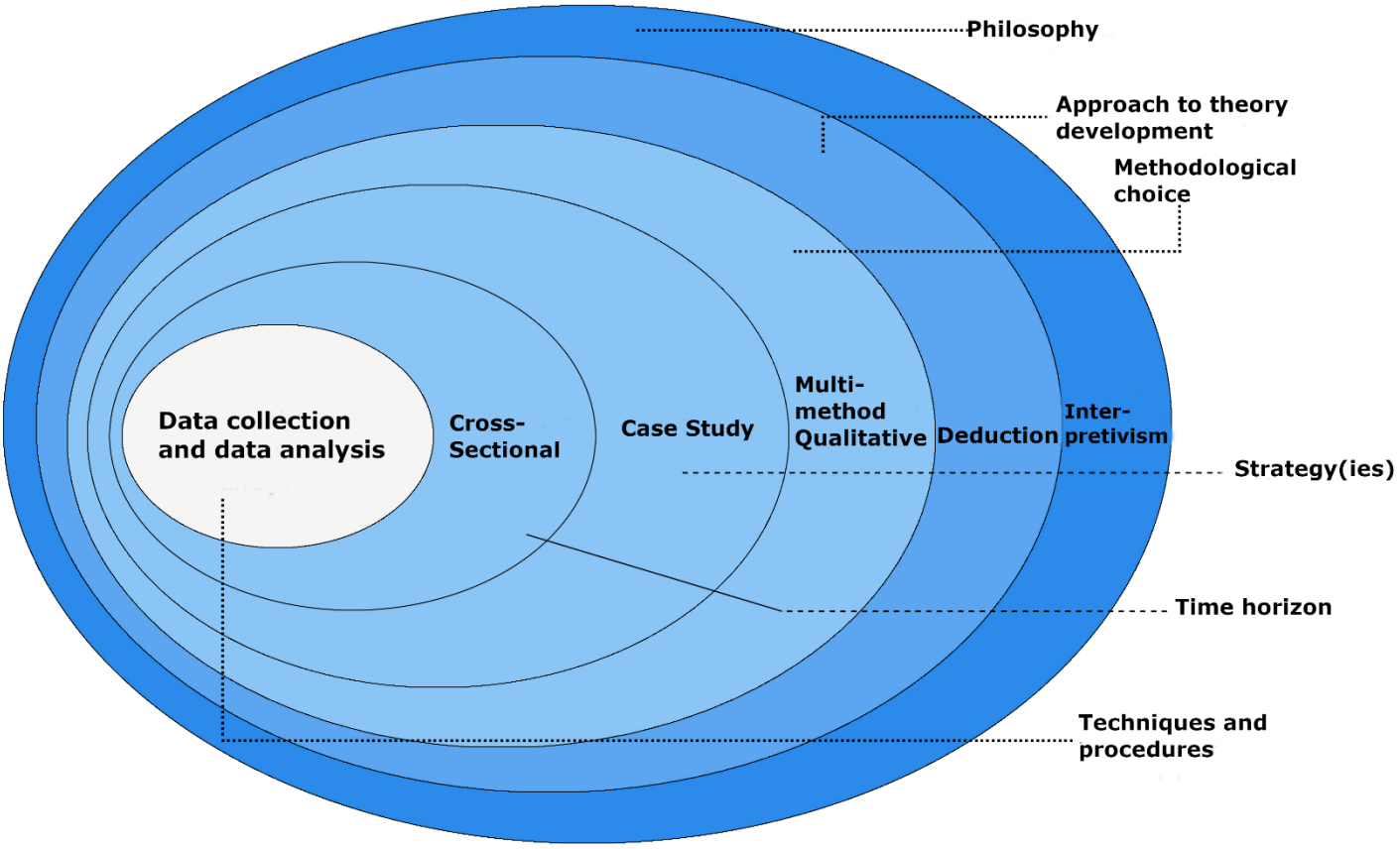


Figure 4: The research onion

The outer, most abstract layer, refers to the research philosophy. The philosophy chosen for this study is interpretivism as this study is about watching the development of student teachers and how they make meaning and apply what they have learnt regarding the design of e-resources. The next layer refers to the approach of the study. A deductive approach will be used for the research, as the concepts in the conceptual framework will guide the theory development. The methodological choice which will be used is a qualitative approach. A case study strategy was deemed appropriate as this study is inquiry-based within a pre-service student teacher module. The time horizon is cross-sectional as it took place over six weeks while the module was presented.

1.11 STRATEGY: CASE STUDY

A case study, as defined by Scholz and Tietje (2002), is an inquiry which is guided by experience or experiment, which investigates a problem within its real-life context. It involves the integration of dependent variables or segments of evidence which are gathered partially through personal observation (Scholz & Tietje, 2002). It allows the researcher to form an understanding of a complex issue and can add validity to what had already been researched in the past. It allows for opportunities to "triangulate data to strengthen the research process" (Maree, 2007; Mark et al., 2009; Miles et al., 1994; Yin, 2009).

An exploratory case study can be defined as the research into a hypothetical or theoretical idea. The objective of an exploratory case study is to see if what is currently being researched could fit into an already existing theory (Crabtree & Miller, 1999; Mark et al., 2009; Maree, 2007; Yin, 2009).

This case study is a critical analysis of a module within a teacher training course. The module on which the study is based is a core module which is presented over six weeks. It is compulsory for all third-year pre-service student teachers who are studying education. The participants in this study were pre-service student teachers of the university who attended the support sessions, submitted the assignment and completed the online survey. The problem, in this case, is identifying the challenges of student teachers regarding their understanding of not only content but also integrating technology in a lesson. The case study will be exploratory as the study aims to see if it can fit in an already existing conceptual framework, which is the SQD model.

1.12 POPULATION AND SAMPLING

The study was conducted on the third-year students who were registered at the university and had to complete a compulsory core elective. The population of students in the group amounted to 1200 students. The sample is those students that consented and participated in the various data collection opportunities described in the next section. The sample is diverse in terms of socio-economic status, cultural background and experience with ICT.

1.13 DATA COLLECTION

There are two instruments which will be used to gather data for this study. These include surveys which the students had to answer and a focus group interview with the lecturers of the module. The data collected will be analysed by using the conceptual framework, meaning the data will be categorised according to the different elements on the conceptual framework. The table below summarises the data collection of this study.

Table 2: Data collection for this study

Instrument	Number of participants	Who was involved
Survey	201	Pre-service student teachers
Focus Group	2	Lecturers of the module

Table 3 shows the codes for different research questions which will be investigated during the study.

Table 3: Codes for the research questions for this study

Key	Sub-research question
SRQ1	How do lecturers view their role in preparing preservice teachers for technology use?
SRQ2	How do students experience the implementation of technology use in their own teaching practice?

1.13.1 Focus group interview

A focus group interview took place with the lecturers of the module. Questions regarding their teaching approach, support structure, teaching experience and modification of teaching were asked. The focus group interview was captured on a voice recorder. This data is useful when addressing the meso-elements of the conceptual framework.

1.13.2 Survey

An online survey was conducted among the participants using the Qualtrics software. Questions regarding their experience of the module were asked in the survey. Various questions regarding the demographics of the group (e.g., what is

the phase and subject specialisation) and their experiences were asked. The questions in the survey were open-ended, and participants were not compelled to answer. From the seven questions asked, only three questions were used for the data analysis. These are questions 4, 5 and 6 as highlighted below. Participants did not have to complete the survey as it was voluntary. Table 4 below shows the questions which were asked in the survey.

Table 4: Questions asked in the survey with key

Key	Question asked in the survey	Where the data fits within the Conceptual Framework
SQ1	What school phase are you focusing on?	
SQ2	What subject field/s are you focusing on?	
SQ3	Share the best apps/websites/resources that you found during your work on the OER pack. A name, URL and brief description will suffice.	• Training Staff • Access to resources
SQ4	Describe positive experiences and lessons learnt during theme 3 about the use of technology in education	• Training Staff • Access to resources • Authentic Experiences • Instructional design • Reflection • Role Model
SQ5	Share the challenges you experienced during your work on the assignment for Theme 3	• Training Staff • Authentic Experiences • Feedback • Reflection
SQ6	What did you learn through and about assessment/online assessment during the Peer Assessment process?	• Collaboration • Feedback
SQ7	Please share any other comments or ideas with us. Your valuable input is much appreciated	• Training Staff • Access to resources • Authentic Experiences • Role Model

1.14 DATA ANALYSIS

The data collected in this study was analysed according to the different aspects of the conceptual framework. Each instrument was used to investigate different elements of the framework. Table 5 shows the various themes within the conceptual framework along with which research questions was investigated, the theme and the data instrument which were used to address the problem.

Table 5: Conceptual framework themes and data collection instrument

Key theme	Research Question addressed	Data collection instrument used
Technology planning and leadership	SRQ1	• Focus group interview
Cooperation within or between institutions	N/A	N/A
Training staff/ Staff development	SRQ1	• Focus group interview
Access to resources	SRQ1 SRQ2	• Focus group interview • Survey
Instructional Design	SRQ1 SRQ2	• Focus group interview • Survey
Authentic Experiences	SRQ1 SRQ2	• Focus group interview • Survey
Collaboration	SRQ1 SRQ2	• Focus group interview • Survey
Feedback	SRQ1 SRQ2	• Focus group interview • Survey
Reflection	SRQ1 SRQ2	• Focus group interview • Survey
Role models	SRQ1 SRQ2	• Focus group interview • Survey

1.15 ETHICAL CONSIDERATIONS

Ethical clearance was obtained with the university and permission was granted from the Ethics Committee for the research to take place. The participants of the study were aware that if they completed the online survey, they would be partaking in a research project. Participation in completing the survey was voluntary for the students. This was discussed with participants in the class, and they were notified when they completed the survey. Their identity was protected at all times as no names, or personal information were disclosed within the research.

Participants who participated in the interview and took part in the focus group discussion were made aware that they were being recorded and the recording would

be used for research purposes. Once again, their identity was protected, whereby they remained anonymous.

1.16 CONCLUSION

The following study is an analysis of a module within the faculty of education at a university. This module was developed to prepare pre-service teachers to integrate technology when designing interventions. The study was guided by the SQD model, which was developed by Jo Tondeur (Tondeur et al., 2012). The model focuses on the focal points which should be taken into consideration when preparing pre-service teachers for technology use. Chapter 2, the literature review, will focus on the various themes of the conceptual framework.

2. CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

The literature study will focus on the various elements of the conceptual framework, the SQD model, as shown in Figure 3. The SQD model has three parts, with each part focusing on different elements. These parts are:

Macro: The outer most circle refers to the factors which cannot be directly controlled such as the Department of Basic Education and the faculty of education at any university.

Meso: The second circle in the model refers to the University and how the content taught to students could benefit them when they are in the classroom one day. It also shows the various factors which influence the preparation of pre-service teachers for technology use.

Micro: The third circle in the model refers to when pre-service teachers are out during their teaching practice and what factors might hamper their intention of making use of technology in the classroom.

2.2 MACRO

2.2.1 Systematic and systemic change

ICT can be seen as a factor which holds plentiful opportunities in terms of spreading education in the developing world. It opens up windows of possibilities for various social pedagogies, access to a wider variety of resources and increased flexibility and knowledge sharing. ICT can be seen as a factor which bridges the gap between the various knowledge divides and the digital gap (Hooker, 2010). The effective use of ICT means “a change in the school culture”. Technology has caused educators to change their teaching methodologies and strategies due to the vast amount of material available online (Krish & Zabidi, 2017).

The Minimum Requirements for Teacher Education Qualifications states that teachers should be able to form alliances between the different types of knowledge and practices. They should also be able to work flexibly in various contexts. Practical

learning involves using a variety of resources across various contexts in order to practice and “form a basis for learning in practice”. Practical learning should be structured and integrated into learning programmes and should include supervision, assessment and mentoring (DHET, 2011).

According to *The Revised Policy on the Minimum Requirements for Teacher Education Qualifications*, there are various capabilities which newly qualified teachers need to possess. These include having a vast amount of knowledge and skills in IT. These IT skills cannot be seen in isolation. Instead, it should be seen in the context of the following:

- The subject knowledge of the teacher
- Knowledge of the methodology of the subject
- The individual needs of the learners
- Resource availability
- Classroom management
- Various assessment approaches (DBE, 2015)

When teachers use technology with the intention of learning, they should pursue the following objectives:

- Serve as a role model other teachers aspire to become
- Setting clear expectations of teaching with technology
- Enhancing the learning environment by using various materials

2.2.2 Aligning theory and practice

Research shows that technology is most effective when a teacher receives more training in its instructional practices. If planned and thought about correctly, it should include a good balance of learner centredness, feedback and an effective teaching strategy (Krish & Zabidi, 2017). It is said by Russel that “teachers and school leaders would benefit from exposure to new models of teaching that capitalize on specific instructional uses of technology” (Russell et al., 2003). Teachers need to keep in mind when using technology in a classroom that it should not serve as a form of replacement for the teacher, but it should enhance the lesson being taught. With

that being said, teachers need to prepare themselves to be life-long learners as their self-efficacy needs to increase (Krish & Zabidi, 2017).

Teacher Training Institutes face the challenge of selecting and implementing strategies to prepare pre-service teachers for technology integration in the classroom. Although some TTIs have used the topic of technology integration as an introductory course, it should be integrated throughout the curriculum. In this way, pre-service teachers will be provided with the necessary knowledge, skills and experience needed to apply technology effectively in their classrooms. Education programmes do provide various approaches to technology integration; strategies include delivery of content, hands-on activities, the practice of technology integration as well as reflections (Tondeur et al., 2012).

One of the reasons for the disparity between the use of technology in the classroom and current practice is the lack of experience or teacher training. Instructional technology should be taught to demonstrate the technology as a means of enhancement for a lesson. This will allow pre-service teachers to acquire skills and eventually, the experience to experiment with different forms of technology (Marino et al., 2009). Experience to experiment with different technologies will increase the self-efficacy beliefs of pre-service teachers, which will ultimately affect their intention of using technology in the classroom (Han et al., 2017). Another objection towards the disparity of use of technology in the classroom is the reluctance teachers display when it comes to integrating technology in their specific subject. Lack of resources in some occasions leads to the disempowerment of technology use which in turn proceeds into lack of self-efficacy beliefs and negative attitudes towards technology integration (Hew & Brush, 2007).

2.3 MESO

2.3.1 Technology planning and leadership

Technological equipment such as computers, tablets and educational software have been placed in schools and knowledge and skills have been provided to teachers. Despite all the training and equipment provided to educators, the equipment

remains unused as teachers are not keen to adapt their teaching methods to integrate technology in their lessons (Kim & Baylor, 2008).

There remains a difference between the various institutions and how they prepare pre-service teachers to integrate technology in their practice. According to Tondeur, technology planning should be:

I. Developed together with the various collaborators;
II. Supported by various parties for technical and instructional purposes;
III. Empowering learners; and
IV. Regularly updated (Tondeur et al., 2016).

2.3.2 Training staff

The rapid growth of technology has formed a challenge in terms of integrating technology into classroom practices. Although sufficient knowledge is essential when considering technology integration in the classroom, another defining factor is the display of confidence when considering its integration in the classroom (Abbitt, 2011). The more exposure and experience pre-service teachers have with technology integration, the better equipped they would be when implementing technology practices in their classroom. Russel and Tondeur state that a gap exists between what pre-service teachers are taught regarding technology integration and how teachers actually use technology in the classroom. Due to this, pre-service teachers feel that they are not effectively equipped with sufficient knowledge to use technology in their classrooms .(Russell et al., 2003; Tondeur et al., 2012)

Although the pre-service and newly qualified teachers are more exposed and comfortable to use technology daily, they require training to see the value of technology integration as an instructional tool in the classroom. They may have been brought up in a time where they were exposed to technology; however, that does not influence the confidence levels pre-service teachers have when it comes to integrating technology in the classroom. The focus should be on how technology integration should take place during formal teaching and not how to make use of technology (Russell et al., 2003).

The use of computers outside the classroom environment is rather pervasive among teachers, however its use within a classroom is very limited. This is because teachers do not understand how to integrate it in normal classroom practice, and school systems have not been structured to support technology integration during teaching instruction (Russell et al., 2003).

A lot of educators do not have sufficient knowledge, skills or self-efficacy to model or teach pre-service teachers how to integrate technology in the classroom (Tondeur et al., 2016). A challenge which is being faced is trying to understand the knowledge, attitudes and beliefs of pre-service teachers and how these challenges could affect their futures as qualified educators. The beliefs and attitudes of a pre-service teacher give a good indication of how they will integrate technology in their classroom one day as well as how effective this technology integration will be (Abbitt, 2011)

Self-efficacy beliefs are influenced by decisions, behaviours, prior experience, cultural contexts and pedagogical beliefs, among other characteristics. Abbitt suggests four primary influences on self-efficacy. These are; “enactive mastery experiences, vicarious experiences, social influences and physiological and affective states”. Research shows that vicarious learning experience and goal setting showed the highest increase in self-efficacy beliefs (Abbitt, 2011). An increase in self-efficacy beliefs is important as it is a determining factor as to what the educator's intentions are for technology use in the classroom as well as their implementation process (Han et al., 2017). Another influence of self-efficacy beliefs is technology integration and the use of computers in the classroom. These beliefs have an impact on the decision as to whether technology will be used in the classroom or not (Abbitt, 2011). According to Peter Albion, an educator’s beliefs about technology integration in the classroom are directly linked to their practice (Albion, 1999).

There is a lack of “technology knowledge and skills, technology supported pedagogical knowledge and skills and technology related classroom management knowledge and skills” among pre-service teachers. This causes a barrier for effective technology integration to take place (Hew & Brush, 2007). The TPCK

framework has been used as an aid to assist teachers to integrate Technology, Pedagogy and Content Knowledge in their classrooms. It provides a valuable structure in terms of teacher willingness and dynamics technology has to offer in the teaching and learning process. When strategizing how to support students in a technology-integrated classroom, the TPCK model influenced the self-efficacy beliefs of the beginner or pre-service teacher. The more experience or exposure pre-service teachers have with technology integration in the classroom, the more complex their views become. As their technology skills evolve, they can make choices about what will work well in their classrooms one day (Abbitt, 2011). If teachers have a support base where they can integrate technology into their teaching practice, their planning would be made simpler and easier, Technology-Supported-Pedagogy can be categorised into three functions, namely; replacement, amplification and transformation (Hew & Brush, 2007).

Failure to expose pre-service teachers to technology integration will lead to frustration, which will, in turn, give them a negative mindset of technology usage in the classroom. When preparing pre-service teachers to use technology in the classroom, one should keep in mind to assist with the selection, adoption, implementation and assessment of technology for it to be effectively used in the classroom (Marino et al., 2009). Technology integration isn't only about technological skills; teacher motivation plays a major role in the successful amalgamation of technology in the classroom (Kim & Baylor, 2008).

2.3.3 Access to resources

There is a variety of definitions of the term "resources". Resources in the teaching context can include worksheets, learning content, images, videos, podcasts, e-books and e-resources, among others. With regards to technology integration, resources include hardware, software and other technological devices such as tablets, cell phones, virtual reality sets etc. (Tondeur et al., 2016). In the context of the model being described, the first definition of resources in teaching will be used. Materials are an essential part required to enhance a lesson. Materials include items such as videos, images, podcasts, e-resources, e-books and worksheets. The variety of materials available supports students with various learning styles. Student

learning is effective when the content and pedagogy capture the learner's interest. Availability and accessibility of resources remain a problem among educators (Pilli & Admiraal, 2017).

Open Educational Resources (OERs) provides resources to teachers which are freely available and open to use. When referring to openness, the resource should have minimum restrictions in terms of technical obstructions, legal issues and price barriers. The resource should be open for adaptations to take place to suit the teacher's needs, provided that the original curator of the resource is given credit for his work. An OER should include learning content, tools and resources which can be used to implement the content being taught (Hylén, 2006).

Amid the many challenges of encompassing OER, the lack of awareness among educators are one of these challenges. Educators feel intimidated when they see licencing procedures, thus they back away or avoid using the resource. Another challenge posed to the OER movement is the unwillingness of academics or educators to share their work. These individuals feel if their work is being shared, they will not be given credit for being the curator of the resource. With the growing amount of OER available, quality assurance remains a barrier. Educators and self-taught learners are on the lookout for resources, and with the large variety available, there is difficulty in differentiating what qualifies as a good resource and what does not (Hylén, 2006).

2.3.4 Cooperation within/between institutions

Promoting technology integration in the classroom is a rather complex process, especially when trying to integrate it with the curriculum of a Teacher Training Institution (TTI). Only once the technology is well infused within the curriculum, allowing pre-service teachers to understand and experience technology, will they understand its pedagogical value in the classroom. It is argued that TTIs should not only focus on how technology can be integrated into the classroom, but also how technology can be directed through using the TPCK model (Tondeur et al., 2016).

It is said that TTIs do not adequately prepare pre-service teachers to use technology in the classroom. This could be done by providing them with experience and knowledge on how to do so (Russell et al., 2003). Opportunities to apply technology to their teaching should also be provided to these pre-service teachers (Teo et al., 2008). According to Russell “teacher preparation and training to use education technology is a key factor to consider when examining their use of computers and the internet for instructional purposes” (Russell et al., 2003).

With the growth of technology rapidly expanding, the new generation of teachers is faced with the challenge of integrating technology in the classroom more than teachers who have graduated in the past — thus placing pressure on TTI to include technology in their curriculum. TTIs are expected to train pre-service teachers how to design assessments and enhance digital learning experiences for the 21st-century learner. TTIs have included an introductory course on the integration of technology in the classroom, however, various studies show that technology is still underused by pre-service teachers and only a handful of these students can use technology in “diverse and flexible ways” (Tondeur et al., 2016). Using the TPCK model to develop the knowledge, skills and propensities of pre-service teachers can be supported by integrating teaching practicals, coursework and field experience (Marino et al., 2009).

2.4 MICRO

2.4.1 Role model

With time, education has been rapidly revolutionised when it comes to content delivery and integration of technology with it. Teachers need to keep up with the teaching approaches as well as the various pedagogical designs. Along with these advances, a new set of challenges have been created for the newly emerging teacher (Krish & Zabidi, 2017)..

Research shows that the development of technology, especially among pre-service teachers, is a rather multifaceted process. Teachers are required to develop various skills and capabilities (Tearle & Golder, 2008; Tondeur et al., 2012). It is noted that during the first few years of teaching, beginner teachers are faced with various

challenges which include adapting to school culture, assessments, behaviour management, and familiarising themselves with the curriculum. These factors make it difficult for exploration regarding the integration of technology in the classroom to take place. Only once beginner teachers have found their ground, and are in their comfort zone, will they make an effort to explore the different ways technology can be used in the classroom (Russell et al., 2003).

Apart from educators needing the necessary knowledge and skills for successful integration of technology in the classroom, teachers need to display good mentorship in the context of integrating technology in the classroom. The following are seen as important requirements for it to be effective:

I. The educator should focus on content

II. There should be an opportunity for hands-on experience

III. The technology should be consistent with the educator's needs (Hew & Brush, 2007).

According to Marino, examples of technology integrated lessons should be provided to pre-service teachers so they can build and get an idea of a technology-enhanced lesson. Various resources such as videos, pictures and applications can be used as "tools" when integrating technology in a lesson. According to Marino, "a dynamic interplay exists among students, teachers, curriculum, classroom context and technology". Integration of technology aims to enhance life-long learning among pre-service teachers and to show the versatility of creating a flexible learning environment (Marino et al., 2009).

Educators in schools should play the role of a "Virtual Change Agent". They should strive to improve pre-service students' attitudes regarding the integration of technology in the classroom. The characteristics of a Virtual Change Agent include providing information, motivating, mentoring and serving as a companion (who collaborates) to the pre-service teacher. Guidance can be given whereby mentors can coach pre-service teachers and assist when selecting a technology to use and envision using it. Additionally, apart from guidance, constructive feedback should be given to these beginning teachers when communicating their ideas to their mentors (Kim & Baylor, 2008).

Pre-service teachers are often put at a disadvantage as they are not taught how to integrate technology into a content area. When in the classroom, the mentor teachers decide whether or not integration with technology will take place. If integration does take place, the pre-service teacher will be given the opportunity to learn how critical the integration of technology in the classroom is. If pre-service teachers' experience with using technology in the classroom is a success, this will automatically lead to a positive mindset when considering integrating technology in the classroom. According to Han, the more experience a pre-service teacher has regarding the integration of technology in the classroom, the more likely that pre-service teacher will be to implement its use in his/her classroom one day. The more exposure a pre-service teacher has during his/her teaching practicals, the greater their commitment will be when deciding to integrate technology in the classroom (Han et al., 2017).

2.4.2 Reflection

With the rapid pace of the integration of technology with education, teachers should keep in mind different ways of adjusting their teaching pedagogies and processes to allow for the ICT integration (Krish & Zabidi, 2017). Research shows that educators with learner-centred beliefs are more successful with the integration of technology in the classroom than those educators who are traditional in their ways of teaching (Albion, 1999).

The success of the integration of technology in the classroom is dependent on the educators' attitudes and beliefs about the usage of ICT in an educational setting (Teo et al., 2008). Attitudes in this regard can be defined as to how teachers feel about using technology in the classroom (i.e. do they like or dislike the use of technology integration). Beliefs on the other hand is a deduction about something which is "felt to be true". Educators' beliefs ultimately influence their attitude (Hew & Brush, 2007).

Data shows that educators' attitude towards the use of technology in the classroom is very important when deciding whether they will use technology in the classroom or not. Russel states that if educators are exposed to different forms of technology

and they can see the benefits the students reap form using technology in the classroom, their attitude might change regarding the impact of technology in the classroom (Russell et al., 2003). Attitudes regarding the use of a computer are influenced by various factors. These factors include; ease of use, confidence when using a computer and the experience while using a computer, among other factors. Factors that influence the instructional use of computers include teacher attitudes, control of behaviour, pedagogical use and general usefulness. An educator's attitude towards using a computer has a major impact on whether a computer will be used later on during teaching or not (Teo et al., 2008).

Pre-service teachers must be provided with the opportunity to observe and practice technology integration in the classroom. Their experiences will determine their self-efficacy and intention of using technology in the classroom. Increased self-efficacy is important as it has an impact on the intention and implementation of technology use in the classroom. The more exposure and experience pre-service teachers have with technology integration, the greater their self-efficacy and intention of using technology in their classrooms will be. A study by Han showed that teaching experiences among pre-service teachers which were technology-centred increased their self-efficacy beliefs, despite what their mentor teacher beliefs were. (Han et al., 2017).

There are three concepts which help pre-service teachers to change their attitudes and beliefs regarding technology integration. The concepts are:

I. **How persuaded teachers are about valuing technology in the classroom:**

Pre-service student teachers need to see the value of integrating technology in the classroom. This can be done through a change of beliefs as well as gaining knowledge on how different technologies work. Knowledge can be divided into two types. One type is "how-to" knowledge", which is learning how to use the technology. The second type of knowledge is "awareness-knowledge" which is endorsing the existence of technology integration (Kim & Baylor, 2008;(Kim and Baylor, 2008, Lester et al., 1998).

II. **How teachers comprehend technology:**

How an individual perceived integration of technology in the classroom is also an important factor which influences attitudes and beliefs towards innovation (Kim & Baylor, 2008).

III. **Concerns teachers have about educational technology:**

When integrating technology in the classroom, it goes beyond the knowledge, skills and demeanour of the educator. Attitude plays a role, as well. Attitude can be influenced by self-efficacy and concerns regarding technology integration in the classroom (Bradshaw, 1997; Kim & Baylor, 2008, Mills & Tincher, 2003; Ward et al., 2002)

2.4.3 Instructional design

Instructional design in this context refers to the planning and preparation of resources for implementation in the classroom (Tondeur et al., 2016). The TPCK model is a Venn diagram which integrates three elements required for technology integration in the classroom. These include technological knowledge and skills, the new knowledge which students will learn (content knowledge) and the pedagogy which teachers will use when combining teaching new knowledge with the aid of technology. The TPCK framework serves as an aid to the pre-service teacher in the manner whereby it helps them to make practical choices regarding what technology to use for a particular lesson. The TPCK framework is highly flexible in the sense that there isn't one particular pedagogy which an educator is bound to use. Instead, one can choose from a multitude of pedagogies depending on what suits your class and lesson. Many researchers believe that technological skills which can be useful in the classroom should be taught to pre-service teachers throughout their studies as opposed to only being exposed to technology when one has to go out on practicals (Angeli & Valanides, 2009; Thompson et al., 2003; Tondeur et al., 2012).

There are three elements which pre-service teachers can adopt to promote learning. These include multiple means of representation, expression and engagement. This can be achieved if pre-service teachers are taught about inquiry-based and active learning approaches in their curriculum. This may change their understanding of integrating technology in the classroom (Marino et al., 2009).

2.4.4 Collaboration

Within the context of the SQD model, collaboration with peers is done in such a way that pre-service teachers need to reflect on their own experiences first before they can evaluate each other (Tondeur et al., 2016). According to Hylén, peer reviews are one of the “most used quality assurance processes in academia”. Although it is well known and used quite often, there are still concerns regarding the quality of the resources which are peer assessed (Hylén, 2006)

Social reinforcement with regards to the attitudes of technology integration has an impact on the beliefs and attitudes of pre-service teachers. If pre-service teachers review their peers in a lesson, positive reinforcement, especially from peers, will have an impact on the beliefs and attitudes of pre-service teachers’ integration of technology in the classroom (Kim & Baylor, 2008; Rogers, 2010).

2.4.5 Authentic experience

Research shows that pre-service teachers’ motivation towards using technology will improve based on the support they receive on the use and development of the amalgamation of technology and teaching in the classroom (Kim & Baylor, 2008). However, even though the younger generation is more familiar and comfortable with using technology, researchers feel they are still not sufficiently prepared to use technology in the classroom (Han et al., 2017). Abbitt suggests that a teaching programme should be structured in a manner whereby students can build confidence when using technology as a tool for learning (Abbitt, 2011). Learning should be seen as a constructive process where one can act and react. Acting includes problem-solving, engaging in enquiry based dialogues and the acquisition of new knowledge. Reaction refers to linking old knowledge to new knowledge and developing new interpretations (Sharples, 2000).

Pre-service teachers with a constructivist approach to teaching have a greater intention of using technology in the classroom than a pre-service teacher with a traditional approach. The pre-service teacher with the traditional approach to teaching will benefit from a technology-centred teaching experience, which will

increase self-efficacy and the intention of usage of technology in the classroom (Han et al., 2017).

Research shows that by providing an opportunity for observation and practice of technology integration in the classroom, pre-service teachers' intentions to integrate technology in the classroom as well as self-efficacy beliefs, increase. If in-service teachers can promote technology integration in their classrooms and share ideas about teaching and learning with technology, pre-service teachers' perceptions of technology integration will be positive (Han et al., 2017).

2.4.6 Feedback

Feedback can be defined as information which is given by an agent regarding an individual's understanding or performance. Feedback, in other words, is the aftereffect results of performance. Feedback will only be useful if the context in which it is used will serve as a learning experience for the recipient of the feedback (Hattie & Timperley, 2007).

The purpose of feedback is to reduce divergences "between current understandings and performance goals". The goals regarding feedback include information regarding how one can be successful by being more committed or increasing effort in the task given (Hattie & Timperley, 2007). According to Brinko, the source of the feedback; i.e. the person giving the feedback also makes a difference. Feedback is also more effective when information is collected from several sources. Added to that, if the source of the feedback is recognized as credible and knowledgeable, feedback is seen as more effective (Brinko, 1993).

2.5 PREPARING PRE-SERVICE TEACHERS FOR TECHNOLOGY USE

Technology allows for active learning to take place through independent or collaborative study experiences. It acts as a mind-tool which expedites critical thinking and learning. Technology can also be seen as a tool which supports cognitive and metacognitive processes, providing information on the go, creating learning opportunities which will not be possible in a traditional classroom and allowing the user to adopt various problem-solving skills. However, this can only be

possible if pre-service teachers possess the necessary knowledge and skills to "incorporate these tools in their instructional planning" (Marino et al., 2009).

2.5.1 Content

E-resources can be defined as a resource which is created through an electronic medium and is available to users to use online or offline. E-resources include e-books, e-journals, pdf documents and web links among others. These resources can be accessed quickly, printed, shared and downloaded in a quick and short space of time (Swain, 2010).

With the advancement of technology, learners are taking advantage of the learning opportunities which are available online, whether it be formal or informal. Learners are carrying around mobile devices, which gives them access to various resources which can be used as learning tools (Kukulska-Hulme, 2010). Mobile learning is about learning across various contexts. It is usually amalgamated with other types of learning (Sharples, 2006). Naturally, learners would use these devices as a starting point when getting new information or accessing new content. The possibilities of using mobile devices as a learning tool open up concerns about how this may impact teaching (Kukulska-Hulme, 2010).

With the ease of use of mobile learning, learners can access content, get information and thus can produce content of their own. This allows them to develop their 21st-century skills. Although these students are still "developing" these skills, it is the educators' duty to guide them as to how to develop these skills successfully (Kukulska-Hulme, 2010).

2.5.2 Strategies

Technology-enhanced learning (TEL) can be described as "the application of information and communication technologies to teaching and learning". TEL consists of one unifying constraint, which is the learner. Everything designed and developed is done so by keeping the students learning in mind. Student-centred learning, on the other hand, allows for learners to construct their own knowledge

while the teacher facilitates the process. The principles of student-centred learning are a) The learner is completely responsible for his learning, b) Learners should be involved and should participate in order for effective learning to take place; c) If students learn among each other, they encourage growth and development; d) The educators role changes to a facilitator and resource person, and e) “the learner experiences convergence in his education” (Kamat et al.).

Student-centred learning, along with the aid of technology, has facilitated and managed different resources making options for learning attainable and achievable. It allows students to access various resources which capture their interests and allow them to decide how to “study at different levels and complexity and deepen their subject knowledge”. Technology supports the process of allowing them to understand, learn and enrich their thinking (Kamat et al., 2017)

2.6 Initiatives for ICT in education in South Africa

Although newly qualified teachers in South Africa know how to use ICT in the classroom, the schools which they work at do not allow them to practice upon these skills due to poor infrastructure. It is mentioned by Burns that South Africa is “simply not ready to use technology to support access to education, improve education quality or manage information” (Burns, 2019).

There are various types of “readiness” which are lacking in South Africa. These include physical readiness, technical readiness and system readiness. These form part of the infrastructural element of integrating technology. Part of the “readiness” includes human readiness. This is the lack of skills and understanding of teachers to integrate technology in their classrooms. Burns mentions “the government placed technology in schools with either little or no basic technology skills training. More critically, the government have not trained teachers how to teach with technology” (Burns, 2019).

Although the improvement of quality of education falls on educators, all stakeholders within the education sector should take responsibility. These include the education officials and school principals. Ongoing professional development should be

provided to all of these stakeholders of a school to support and assist the integration of technology in teaching and learning. In South Africa, professional development programs are in place and are offered to certain government schools. These include ICT4RED and SchoolNet (Burns, 2019).

2.7 CONCEPTUAL FRAMEWORK

A pre-service teacher's development of technology integration is a rather complex process. A crucial factor which influences a pre-service teacher's use of technology in the classroom is the quantity and quality of technology integration experience, which is given to these teachers at a university level. There is a breach in terms of what pre-service teachers are taught at a university level and how technology is integrated into the classroom. The focus of technology integration should not only be recognised for everything that it can do but also how it can be integrated with teaching and learning to enhance this process. Technological skills should be integrated throughout the teacher education curriculum to "provide pre-service teachers with skills and experiences needed to apply technology into their specific content areas" (Niess, 2005; Tondeur et al., 2012). The SQD model indicates the focal points which should be taken into consideration when designing a training plan for pre-service teachers for the integration of technology in the classroom.

Figure 5: The SQD model

The SQD model as illustrated above could be used as an instrument "used to measure pre-service teachers perception of the extent to which the experience, the support and training needed to integrate technology in their educational practices". The reason behind the development of this model is to show how each of these focal points is related in the convolution of the model. (Tondeur et al., 2016).

A combination of different approaches instead of only one approach is needed to prepare pre-service teachers for technology integration. Twelve key themes are necessary for the preparation of technology integration. These themes are either "related to the preparation of pre-service teachers at the micro-level, or to conditions necessary at the institutional level". (Tondeur et al., 2016)

The following key themes were designed to prepare pre-service teachers to integrate technology in their future classrooms:

Table 6: Themes of the conceptual framework discussed through prior research

Key theme	What research says about the theme
Aligning theory with practice	Tondeur states that pre-service teachers are not just interested in the theory of integrating technology with teaching and learning, but also the practical application of what they have learnt. Conceptual and/or theoretical information should be linked to the practical application, so pre-service teachers can understand why ICT is being used in a classroom. Pre-service teachers can understand the reasoning behind integrating ICT in the classroom by linking practice with theoretical and conceptual information. Pre-service teachers were found to lose interest if courses focused only on the theoretical concepts of Integration of ICT in education. They show more interest and are further motivated if they are introduced to ways to make use of technology for educational purposes (Angeli & Valanides, 2009; Goktas et al., 2008; Lavonen et al., 2006; Tondeur et al., 2012).
Systematic and systemic change	It is important to integrate a systemic change process when integrating technology into a curriculum. However, systematic change carries just as much importance. This can be done by introducing a computer course to the first-year students, which they can benefit from throughout their studies (Goktas et al., 2009; Tondeur et al., 2012).
Access to resources	Resources are an important variable if technology is going to be used in the classroom. Access to these resources is needed for using technology as a component of a lesson. Resources in this context refer to hardware, software and various learning materials. (Barton & Haydn, 2006; Goktas et al., 2008; Tondeur et al., 2012).
Training staff/ Staff development	Many qualified educators lack the knowledge, skills and self-efficacy to teach or model technology integration to pre-service teachers. It is also clear from the evidence that teacher educators should be provided with training so they can design their courses based on how pre-service teachers can use the knowledge

	and skills they gained within their subject area (Clift et al., 2001; Tondeur et al., 2012).
Technology planning and leadership	There are differences between training institutions in the way pre-service teachers are currently prepared to integrate technology into their practices. A common policy should be tried and be developed for all of these institutions to use, which includes a shared perception of technology integration. Staff participation remains a key factor when planning and facilitating a technology education programme. Technology planning should be: I. Developed together with all stakeholders II. Supported by a task force for both technical and instructional purposes III. Aimed at the empowerment of end-users IV. Updated regularly (Clift et al., 2001; Goktas et al., 2009; Lavonen et al., 2006; Tondeur et al., 2012,)
Cooperation within or between institutions	"Staff teachers and students spend more time helping each other with technology" (Tondeur et al., 2012). This allows for additional support between different stakeholders as well as unity. This factor was found to be vital for technology integration to be successful. The cooperation between various institutions is critical as this is a determining factor in the success of technology integration training, which would assist pre-service teachers in transferring knowledge to their future classrooms (Thompson et al., 2003; Tondeur et al., 2012)
Moving from traditional assessment to continuous feedback	There is no agreement when it comes to measuring pre-service teachers' ICT competencies and what still needs to be done for progress to be made. What is deemed useful in such a situation is the use of continuous and constructive feedback. An ICT portfolio could be used to integrate assessment throughout the teacher training process. This portfolio gives pre-service teachers an idea of how they can use ICT in their teaching, and at the end, they would have a portfolio full of ideas of the various ways they can integrate technology in their lessons (Tondeur et al., 2012, Lavonen et al., 2006, O'reilly, 2003).
Collaboration with peers	Pre-service teachers' collaboration with their peers provides a low threat and time-effective learning environment and reduces the anxiety of the use of technology in the classroom. It brings a sense of awareness among the pre-service teachers that to evaluate others, they need to reflect on their own experiences. Using an online forum to reflect has no time constraints, and each individual could express his thoughts assiduously (Barton & Haydn, 2006; Jang, 2008; Tearle & Golder, 2008; Tondeur et al., 2012).
Scaffolding authentic technology	Pre-service teachers know the importance of applying their knowledge about educational technology in authentic technology experiences. In addition, support should be offered by educators during the planning and preparation of a technology-integrated lesson. The experience of engaging with technology in the classroom will give pre-service teachers a better understanding of "the link between teaching and theory practice" (Tearle and Golder, 2008; Tondeur et al., 2012).
Instructional design	An encouraging way for pre-service teachers to learn about technology integration is by providing them with the opportunity to redesign curriculum materials which would fit in with the integration of technology. A challenge

	identified among pre-service teachers was the additional planning and preparation that went into planning a lesson when technology integration had to take place. Pre-service teachers feel they are not knowledgeable and experienced enough to design an ICT supported lesson. An important factor in this theme was peer support during the production of materials (Tondeur et al., 2012, Jang, 2008, Thompson et al., 2003).
Reflecting attitudes about the role of teaching in education	The following strategy strongly focuses on observation, discussion and reflection about technology integration in the classroom among pre-service teachers and their peers and pre-service teachers and their mentor teachers. Reflection allowed students to see the value and practicality of integrating technology in their classroom. Additionally, it allowed pre-service teachers to differentiate between the action and purpose of technology integration. A challenge identified within the teaching education programme was the engagement of pre-service teachers and qualified educators in conversation about their attitudes regarding the role of technology in teaching and learning. (Goktas et al., 2009; Brush et al., 2003; Tondeur et al., 2012).
Teachers as role models	Observation of how technology can be used in a classroom proves to be a motivator for pre-service teachers. The strategies which were observed were practised by pre-service teachers while they were conducting a lesson. Although observation is an important motivational factor when integrating technology in the classroom, pre-service teachers watching how integration can take place is "helpful but not sufficient". These examples need to be interpreted in an educational context for it to be useful. Tondeur states that many pre-service teachers have little knowledge or skills when it comes to using technology for teaching and learning. "Because ICT isn't modelled and resources are limited, pre-service teachers are unlikely to think about using it" (Sime & Priestley, 2005; Tearle & Golder, 2008; Tondeur et al., 2012).

2.8 CONCLUSION

The chapter was unpacked based on the conceptual framework, which is the SQD model. A literature review was done for each theme, and the chapter finally concluded with what the creator of the model said about the theme. In the upcoming chapter, the data collection techniques and the analysis procedure will be discussed.

3. CHAPTER 3: RESEARCH METHODOLOGY

3.1 INTRODUCTION

The focus of the study is supporting pre-service teachers to design learner centred e-resources for teaching with technology. Support was given to these student teachers in the form of content, demonstration of technology integration in a classroom, guidance offered by the lecturers and tutors, the assignment and online forums.

The primary research question of this study is as follows:

How can pre-service teachers be prepared for technology use in their own teaching practice?

The secondary questions are:

1. **How do lecturers view their role in preparing pre-service teachers for technology use?**
2. **How do students experience the implementation of technology use in their own teaching practice?**

3.2 RESEARCH ONION

The research onion is a diagram, created by Mike Saunders, which illustrates the data collection techniques and analysis procedures which a researcher has chosen (Mark et al., 2009). These elements are crucial when developing a comprehensible research design which can be adequately explained and justified according to the researcher's study. It delineates which elements need to be taken into consideration jointly with the other elements which make up the research design (Saunders & Tosey, 2013).

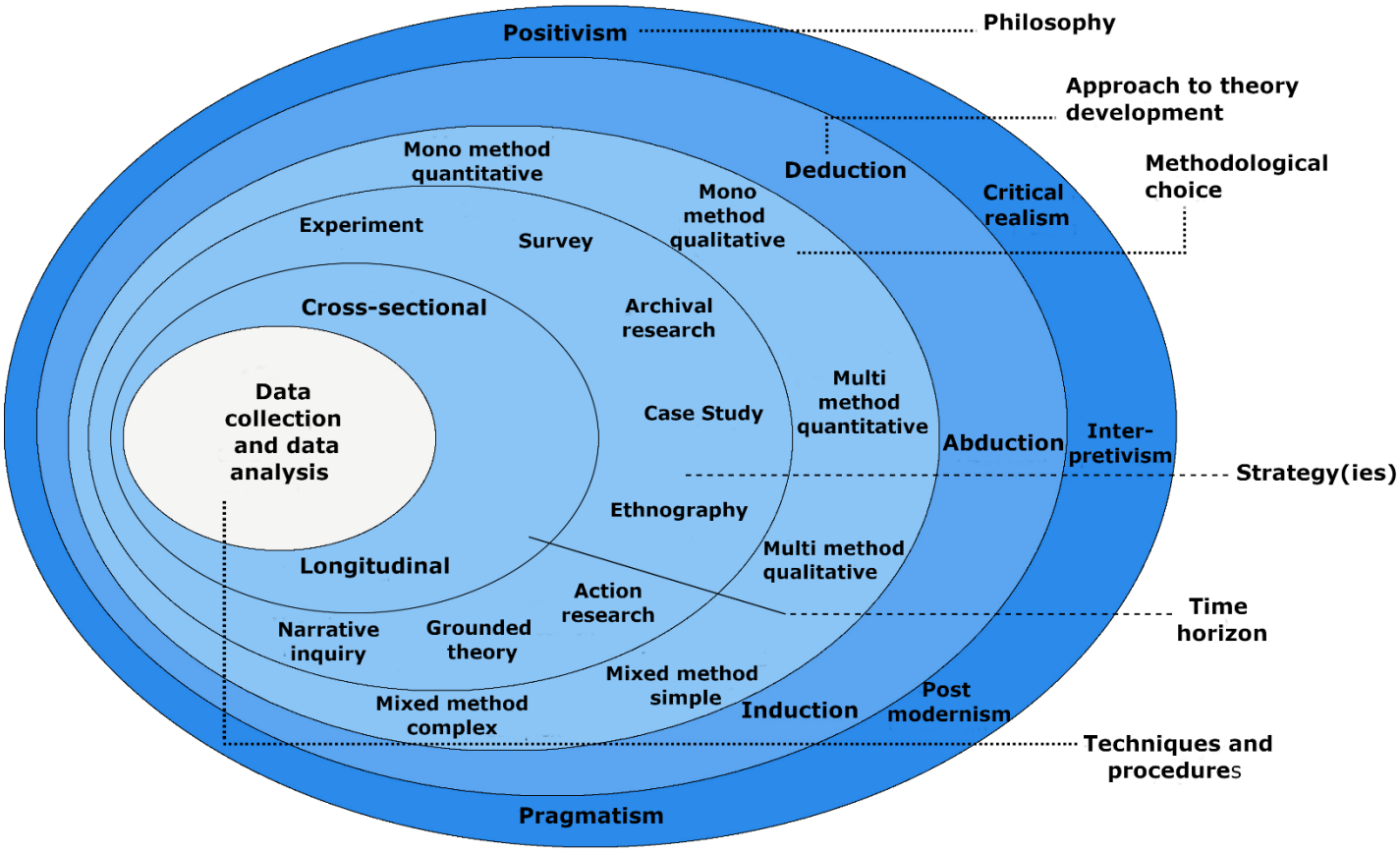


Figure 6: The research onion

Figure 6 depicts the research onion. The outermost layer of the onion presents the research philosophy which the researcher follows when conducting his study. It is the belief system or assumptions about the development of knowledge. The approach which focuses on the second outermost layer involves the theory on which the study is based. The study can either work towards proving an existing theory, generating new results or generating deductible conclusions. The first two layers of the research onion deal with the approach taken when embarking on the study (Mark et al., 2009).

The three innermost layers of the research onion refer to the specifics of the study that will be undertaken, i.e. the research design. The third layer focuses on the methodological structure, the methodological choice, which refers to the research method to be used in the study. Qualitative or quantitative indicates the type of data that will be collected and how it should be presented. The research strategy is the action plan taken to answer the research questions posed in the study. The time

horizon refers to the period over which the study will take place. In other words whether it will it be over a period of time or focus on a series of events (Mark et al., 2009).

The research onion will be used as a guide during discussions on the research methodology. It modularises the different elements of the data collection techniques, which ensures that all elements are covered when unpacking the data analysis of this study. The unpacking of the various elements of the onion allows for each element to be focused on regarding of how it fits into the study.

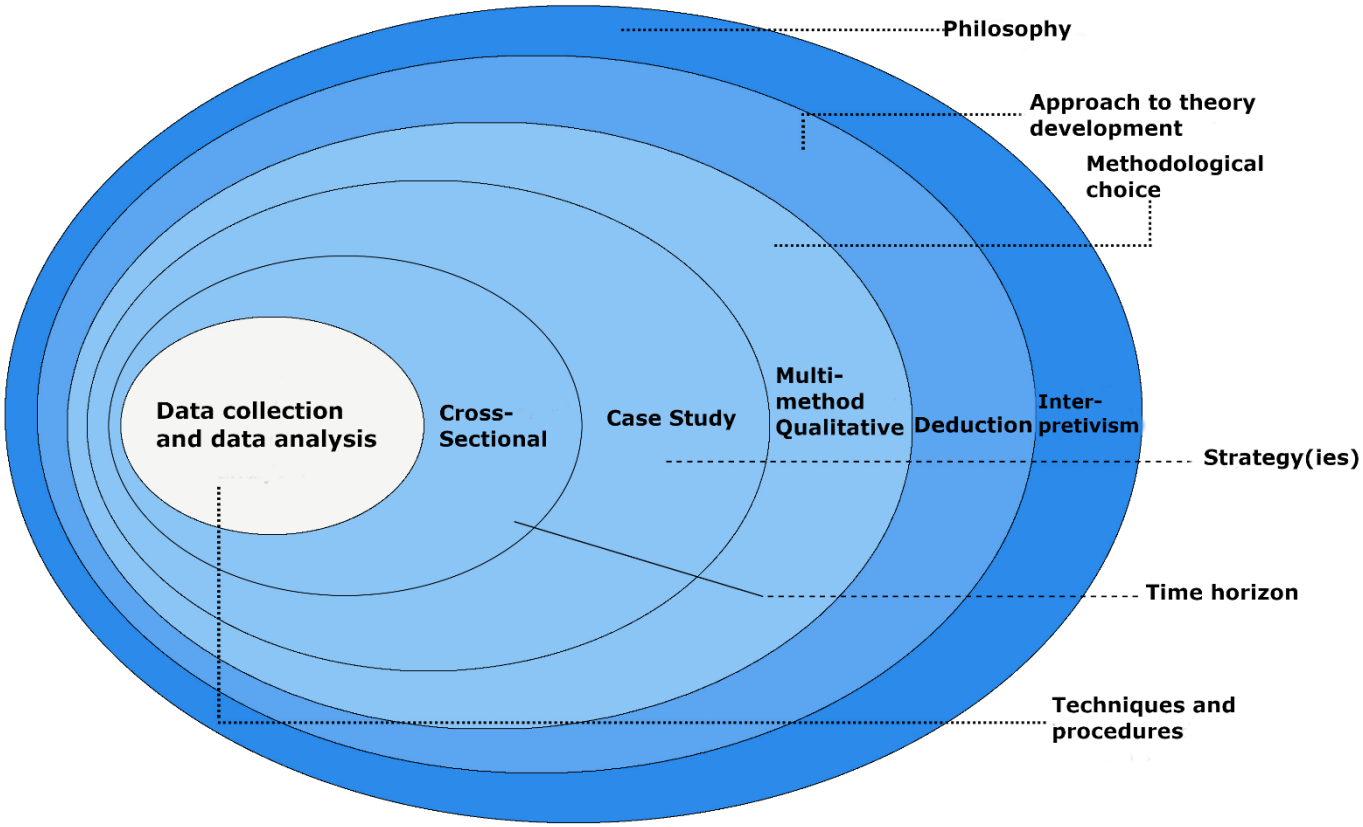


Figure 7: The research onion as adapted for this study

Figure 7 presents the research onion as adapted for this study. It depicts the various elements which guided the study and the investigation of the research questions posed. The philosophy chosen for this study is interpretivism as this study is about observing the development of student teachers and how they make meaning and apply what they have learnt about designing e-resources. A deductive approach has

been used for the research, as the concepts in the conceptual framework guided the theoretical development. Student teachers had to submit an assignment and after that, fill in a survey regarding their experiences and challenges when designing e-resources for a learner-centred classroom. The methodological choice was the multi-method qualitative approach. Data was collected in the form of surveys which were completed by student teachers and a focus group interview conducted with the lecturers of the module. An exploratory case study strategy was deemed appropriate as this study investigates one instance of a preservice student-teacher module in integrating technology into education. The time frame chosen for this study was cross-sectional as it took place over six weeks.

3.3 RESEARCH PHILOSOPHY: INTERPRETIVIST

A research philosophy is “a system of beliefs or assumptions about the development of knowledge”. It is a belief regarding the way in which phenomena should be accrued, interpreted and used (Mark et al., 2009). Interpretivism can be described as the differentiation of humans from a physical phenomenon due to individuals creating different meanings. It argues that all humans come from different cultural backgrounds, with different social circumstances, at various times and make different meanings. These meanings are created; hence, each individual experiences a different social reality (Mark et al., 2009). An interpretivist research aims to offer insight into a context and analyse a situation involving a group of people which is under study. Additionally, it puts perspective into the , or phenomenon they encounter. The role of the researcher is to provide an understanding, explanation and clarity of reality through the eyes of various participants. The interpretivist philosophy is strongly influenced by phenomenology; in other words, it is subjective (Maree, 2007).

Interpretivism was chosen as a philosophy for this study. The purpose of the study is to investigate how student-teachers applied the knowledge, skills and values taught in a module in integrating technology into education. Students had to complete an assignment which had to be done individually. Student teachers were given access to the computer labs for the duration of the module for two hours a day. During this time the tutor was available for additional support.

According to Klein and Meyers, interpretive research assist researchers to understand the thought and actions of humans in an organisational and social context. It produces insight into information regarding the management and development of information systems. There are seven principles of hermeneutics which summarise the viewpoints of interpretivism. These insights are not encapsulated within the practice of interpretive research. The seven principles are different parts which are interrelated to form a whole (Klein & Myers, 1999). The table below shows how interpretivism is incorporated in this study through the seven principles of hermeneutics. These principles will be used to support this study in planning the research and interpreting the data collected.

Table 7: The seven principles of hermeneutics as applied to this study

Principle	
1. The fundamental principle of the hermeneutic circle	
The seven principles together are seen as a circle. This principle is seen as a counterpart as the remaining principles are different parts enjoining to form a whole (i.e. this principle)	This study is based on a conceptual framework which has ten elements within two categories, six elements in the one category and four in the other. The categories are counterparts of each other. Each element is essential in each category for it to function properly. These elements within each of these categories are needed in order for the conceptual framework to form a whole.
2. The principle of contextualization	
This can be described as the understanding between the author and the interpreter of the text. It is finding meaning within the context. Various contexts can be used; however, this depends on the target audience and the story or message the author wants to convey.	The study conducted is a case study. Data will be collected in the form of surveys and a focus group interview conducted with the lecturers of the module. The research conducted will feed within the conceptual framework. This will be explained to the readers in a tabulated form.
3. The principle of interaction between the researchers and their subjects	
This refers to the principle whereby the researcher places himself and his participants relative to each other. The researcher should be a part of the subjects to an extent whereby they are seen as analysts and interpreters of the study.	The researcher places herself within the relativity of the participants during the tutor contact sessions. This is not a formal class where students are spoken to directly or formal learning occurs. Instead students come in as they please and can seek assistance or guidance as it is needed.
4. The principle of abstraction and generalisation	
These are the various concepts which are extracted from common, daily practices and experiences. An example of this would be a misunderstanding due to language.	Within the study conducted, language could be misinterpreted as some students might not have English as a first language. Additionally, students

	might misinterpret what the lecturer says during class due to unanticipated distractions.
5. The principle of dialogical reasoning	
This principle urges the researcher to challenge his biases, which guided his original research design, with data which arose from the research process. The researcher should be as clear as possible when confronting these prejudices and justifying it with data collected.	The data which was analysed was done so with the guidance of the themes' conceptual framework. In cases where the data could not be linked to the themes of the conceptual framework, sub-themes were identified and thereafter linked to the themes of the conceptual framework.
6. The principle of multiple interpretations	
Within a social context, there are various influences which could hamper an individual's actions. The researcher should examine these influences and try to document various viewpoints and reasons for these stimuli.	Multiple interpretations could be applied in this study, where students are in an informal learning environment during the tutor sessions. Depending on their surroundings, something as simple as a text message could influence their actions.
7. The principle of suspicion	
The above principles focus mainly on the interpretation of meaning rather than fabricated predispositions. There are instances whereby false preconceptions will occur; however, the idea is to reveal the effects of socially created distortions and psychopathological delusions.	A critical perspective was taken when analysing the data of the surveys. The respondents of the survey were anonymous; hence, there are no distortions which can be created based on the response received.

3.4 RESEARCH APPROACH: DEDUCTIVE

The deductive approach is whereby a generalisation is made based on a theory or framework, and research is conducted to see whether these generalisations apply to the theory or framework chosen (Hyde, 2000). It sees the development of a theory or framework which is referenced in a study and taken through a test of various propositions to see how data collected correlates with this theory or framework. The characteristics of a deductive approach include explaining the relationship of how variables and propositions align, the concepts of the theory or framework need to be measurable, and careful selection of the sample size is required.

A deductive approach was chosen for this study as the conceptual framework is used as a guide for the study. Data collected was fed into the conceptual framework whereby the various elements of the framework were justified through the surveys which students had to complete and the focus group interview which was conducted.

3.5 METHODOLOGY: QUALITATIVE

The qualitative methodological approach uses a variety of “data collection techniques and analytical procedures” to develop either a conceptual framework or a theoretical contribution about the participants’ connotations and relationships between these connotations regarding the study being conducted (Mark et al., 2009). Qualitative data collection focuses on a natural setting where interaction takes place. It is dependent on obtaining access and connecting with participants to gain insight into their data. It pays specific attention to the interaction, which occurs in processes instead of fixed behaviour. Data is collected linguistically instead of numerically, with the objective of a meaning-based data analysis. It makes use of open and exploratory research questions, emphasising the perceptions of phenomena in a natural environment. It makes use of various strategies to enhance the trustworthiness of the research design and data analysis (Maree, 2007).

The variety of data which was collected is in the form of surveys and a focus group interview conducted with the lecturers of the module. A qualitative approach was deemed appropriate as the data collected, specifically from the students, was based on open ended questions.

3.6 STRATEGY: CASE STUDY

A case study, as defined by Roland Scholz, is an inquiry which is guided by experience or experiment, which investigates a problem within its real-life context. It involves the integration of dependent variables or segments of evidence which are gathered partially through personal observation (Scholz & Tietje, 2002). It succeeds by allowing the researcher to form an understanding of a complex issue and can add validity to what was already researched in the past. It allows for opportunities to “triangulate data to strengthen the research process” (Leech & Onwuegbuzie, 2007; Maree, 2007). The term “case” in “case study” refers to participants who are engaging in the study. To understand the dynamics of the topic which is being studied, various factors need to be taken into consideration. These include the case which is being studied and the boundaries of the study (Mark et al., 2009). A case study usually arises due to the indistinguishable phenomena which occur in a real world context (Yin, 2009).

3.6.1 Design of the study

This design of the case study is a logical sequence which connects the data collected to the research questions posed and its conclusions. The main purpose of a research design is to avoid a situation where the evidence does not correlate with the research question (Yin, 2009). Figure 8 shows the five elements necessary in a research design.

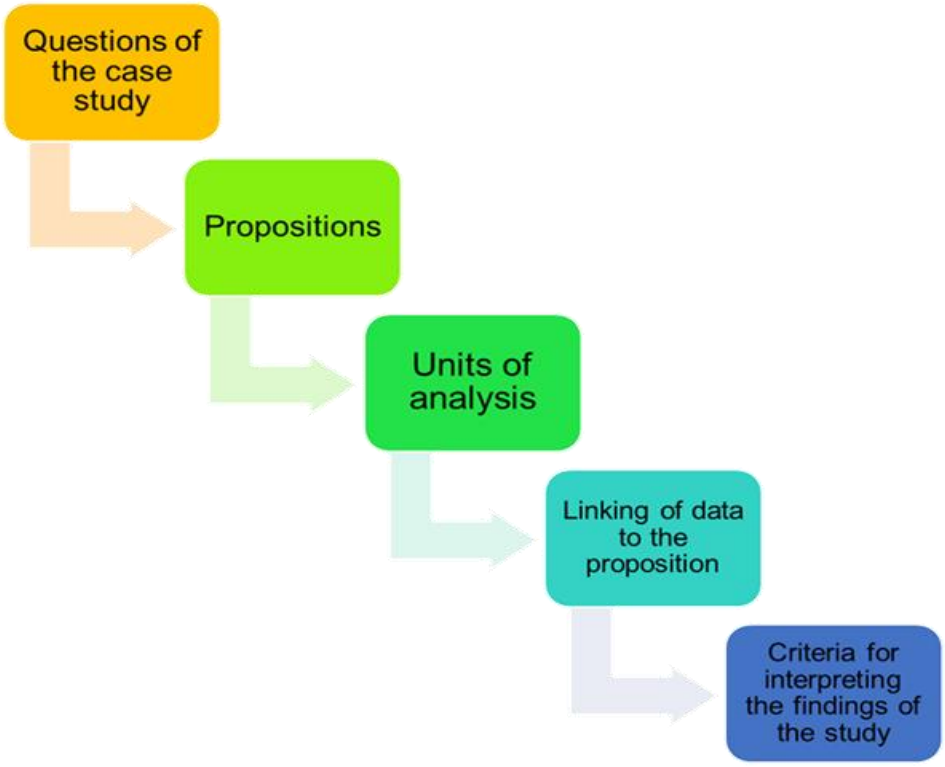


Figure 8: The elements necessary in a research design

i. **The questions of the case study**: This refers to the questions posed in the case study. It provides a clue about the research method which will be used. Questions within the case study include “who”, “what”, “where” and “how” questions (Yin, 2009) .

ii. **The propositions:** The propositions of a study include something which should be “examined within the scope of the study”. The propositions tells the researcher where evidence could possibly be found. The proposition could be in the form of an existing theory or framework (Yin, 2009).

iii. **The units of analysis:** This is defining what the problem of the related case is. The unit of analysis depends on the way the research questions have been construed. In each case which is under study, the individual or group of participants is usually the unit of analysis. In order to choose an appropriate unit of analysis, one needs to “accurately specify the primary research questions” (Yin, 2009)

iv. **Linking of data to its propositions:** This is the link between data collected which could be linked to an existing framework or theory which your case study is based upon. In other words, it is a reflection of the initial study propositions (Yin, 2009)

v. **The criteria for interpreting the findings of the study**: This refers to the comparison of two or more rival explanations for the findings. The more contention there is within the case study, the stronger the findings will be (Yin, 2009)

The design for this study is as follows:

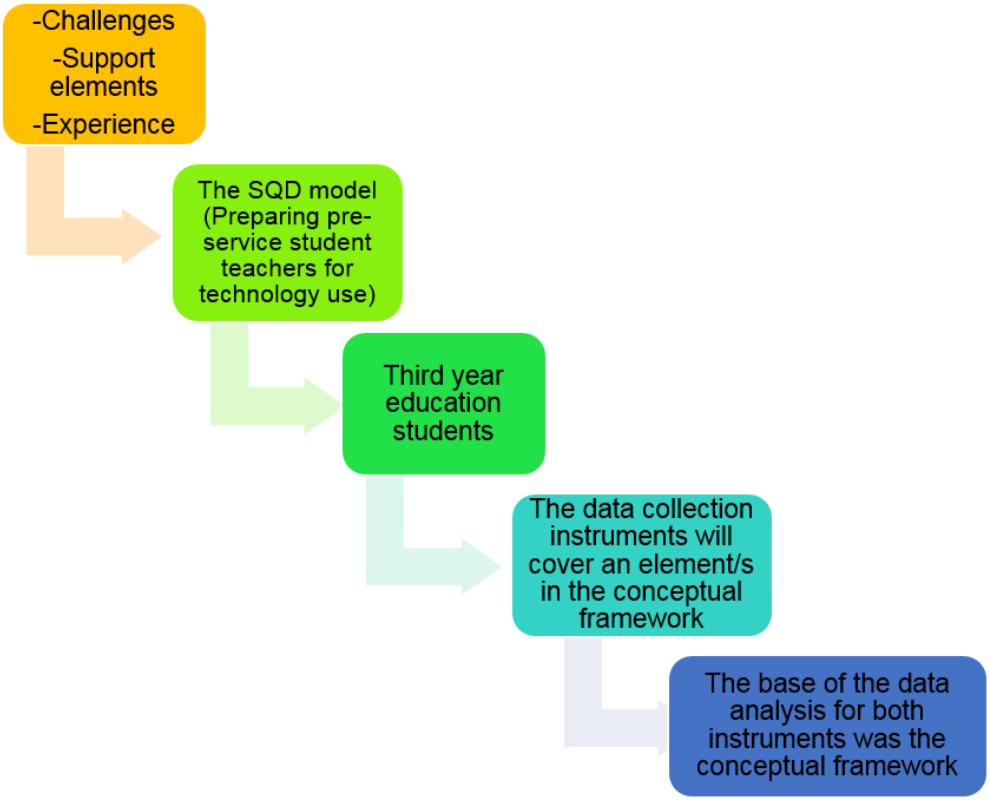


Figure 9: The research design for this study

The questions of the case study include the challenges student teachers face when creating e-resources; the various support elements are necessary to support the students and the way in which students experience this support.

The proposition of this study is a conceptual framework, the SQD model (Preparing pre-service teachers for technology use). The model includes three levels (micro, macro and meso) which are reliant on each other for the success of the preparation of pre-service teachers' use for technology in the classroom, however, in this study the focus will only be on two levels (i.e. the macro and micro levels).

The units of analysis include the third year education students who completed the module. However, not all of these students completed the survey.

The data collection will be explained through the conceptual framework. The two data collection instruments will be used in order to cover various elements of the conceptual framework. There are ten elements within the conceptual framework which will be researched.

The criteria for interpreting the findings of the study are based on the themes of the conceptual framework. During the analysis process, if data could not be linked directly to the conceptual framework, sub-themes were identified. Thereafter the sub-themes were linked to the themes of the conceptual framework.

3.6.2 Purpose: Critical analysis

The module which will be critically analysed is a technology integration module in the faculty of education at a university. The module takes place over a period of six weeks. In the module students are exposed to various teaching strategies along with how to use these strategies while integrating technology. As a form of assessment, students are asked to complete an assignment whereby they need to design a learner centred e-resource. They need to include various e-resources within their assignment, either created or found online. The lecturers' point of view of the module will be studied as well as the students' point of view. The lecturers' data will be captured through a focus group interview while the students' experiences will be captured through a survey which students had to complete. Refer to Chapter 1, Section 1.2, for more detail on the module, which will be critically analysed.

3.6.3 Exploratory case study

An exploratory case study can be defined as the research into a hypothetical or theoretical idea. The objective of an exploratory case study is to see if what is currently being researched could fit into an already existing theory. Exploratory case studies can be used to ask open-ended questions and to gain an understanding of

a topic of interest. This type of a case study is beneficial to gain clarification of a problem, issue or phenomenon. Exploratory case studies are flexible and adaptable. Based on the data collected, one can gain new insight into the study and the research can go in a different direction compared to when one started (Baxter & Jack, 2008; Maree, 2007; Mark et al., 2009; Yin, 2009).

The case study which will be researched will be exploratory as the study aims to see if it can fit in an already existing conceptual framework, which is the SQD model. The data collection instruments include a survey, which is made up of open-ended questions and a focus group interview conducted with the lecturers of the module. The problem being studied or addressed in the research includes what challenges student teachers faced when designing e-resources. Additionally, questions regarding how these challenges are supported and how the student teachers experience this support will be explored.

3.6.4 Holistic

A holistic case study relies on narrative and phenomenological descriptions. It is shaped meticulously by a qualitative approach (Scholz & Tietje, 2002). A holistic design has an advantageous point when there is no clear identification of a subunit or when the underlying theory which supports the case study is holistic (Yin, 2009).

This case study is holistic in nature as the tutor directly interacted with the students and cleared any misconceptions and understandings regarding the assignment which they had to complete. Although there are various units of analysis in the study, there is no proof that the students who attended these support sessions are the same student teachers who answered the survey. However, they do form part of the group of students who had to complete the module.

During the focus group interview, the lecturers spoke about their experiences while teaching the module. Topics such as the various teaching strategies, collaboration with students and how they incorporated teaching with technology were discussed.

The students who had answered the survey spoke about their experiences of the module. Students were asked what they had learnt during the course of the module,

what challenges they experienced and what they learnt about online assessment and Turnitin among other questions. The survey was answered anonymously and was voluntary.

3.6.5 Single case study

A single case study is equivalent to a single experiment. Selecting a case is critical when it comes to your theory or theoretical propositions. Clarity regarding the circumstances of the theory should be explained along with whether the proposition is correct or alternatives (along with explanations) are relevant (Yin, 2009).

This case study was based on third year student teachers who had to complete a compulsory core module. This module focuses on technology integration in the classroom and takes place over a period of six weeks. During these six weeks, there were four contact sessions with the lecturer and eight hours of tutor consultation available for the student teachers. During this period students will need to complete a formative assessment in the form of an assignment.

3.6.6 Time horizon: Cross sectional

It involves the study of a specific phenomenon which occurs at a particular time. It describes how the various factors of the incidence are interrelated. The cross sectional time frame usually makes use of surveys (Mark et al., 2009).

The study is cross sectional as it takes place over a six week period and involved a group of students who had to complete a core module. During this period students had lectures to attend as well as support sessions with a tutor. As a form of assessment, students had to complete an assignment regarding the creation of e-resources for a learner centred classroom. After the assignments were submitted, the same set of students had to complete a survey regarding the challenges and positive aspects of the assignment.

3.6.7 Case: The technology integration module case

The case that this study explores is a module for student teachers in integrating technology into education for a teacher training course. The course is made up of various modules. The module on which the study is based is a core module which

takes place over six weeks. It is compulsory for all third year student teachers who are studying Education.

The “case” in this study would be pre-service student teachers of the university who attended the support sessions, submitted the assignments and completed the online survey. These students’ teachers need not be the same throughout. Throughout the study, these students will be referred to as student teachers.

The problem in this case is identifying the challenges of student teachers regarding their understanding of not only content but also integrating technology in a lesson. The focus of the assignment was technology based and some participants might not have had access to a computer or the internet at home. However, this boundary was overcome as student teachers had access to computers for two hours a day for one month to complete the assignment.

3.7 CONCEPTUAL FRAMEWORK

The SQD model indicates the focal points which should be taken into consideration when designing a training plan for pre-service teachers for integration of technology in the classroom. In addition, the model could be used as an instrument “used to measure pre-service teachers’ perception of the extent to which the experience, the support and training needed to integrate technology in their educational practices” is The reason behind the development of this model is to show how each of these focal points are related in the convolution of the model. (Tondeur et al., 2016).

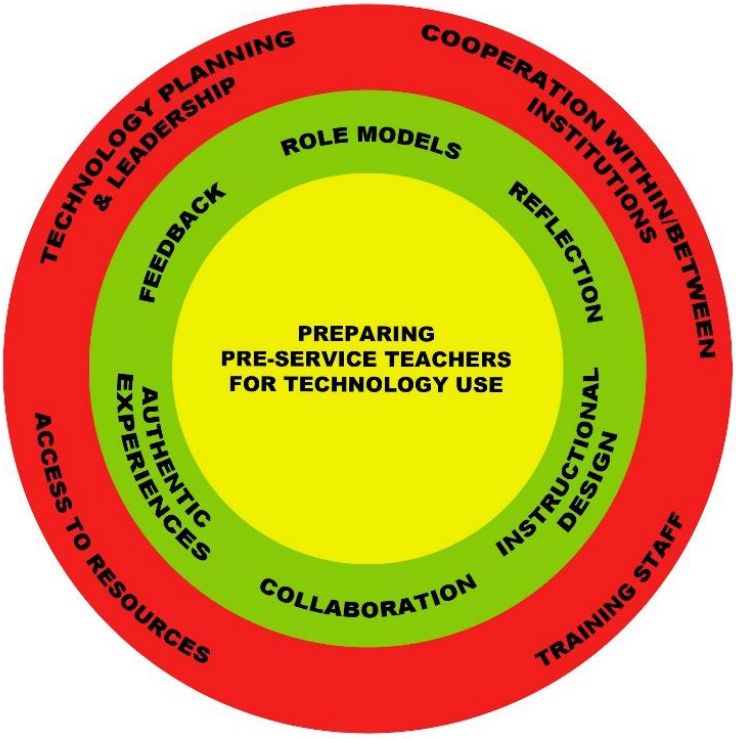


Figure 10: The SQD model as adapted for this study

The study which has been conducted is related to the micro and macro section of the conceptual framework as shown in Figure 10. The macro part (i.e. the red circle) refers to the elements on an institutional level while the micro part refers to the elements of the specific subject being taught. Table 8 illustrates each theme of the conceptual framework with an explanation of how it is integrated in this study.

The study conducted made use of two data instruments. These included online surveys, which consisted of open ended questions which student's had to complete, and a focus group with the lecturers of the module. During the study, all themes in the conceptual framework were addressed with the exception of cooperation within/between institutions as this does not fit in the study. Table 8 depicts the elements of the conceptual framework along with how each element is integrated in the study. The red columns refer to the macro elements and the green columns refer to the micro elements of the conceptual framework.

Table 8: Integration of conceptual framework in this study

Key theme	How the theme is integrated in this study
Access to resources	Resources in this study makes reference to both hardware and software as well as LTSM which students can access. As the aim of this module is to teach and demonstrate technology integration in the classroom, students will need Wi-Fi in order to successfully participate in class activities. Wi-Fi is available in all the lecture halls for students to use. The computer labs are made available for the students for the duration of the module. Students can access these computers during the designated times and use this time to explore various technologies or work on their assignments. It is not compulsory for students to use the labs. The Lecturers communicate and upload all information which students need onto the learning management system of the university. On this platform, students can access class notes as well as communicate with each other regarding anything that has to do with the module.
Training staff/ Staff development	Teachers need to update their knowledge and skills continuously (lifelong learners) in order to be successful when integrating technology in their lessons. With the rapid development of technology and its integration in the classroom, there is always new apps or resources available to use. Demonstrations regarding integration of technology in a classroom will vary year to year as there is always something new to explore and introduce to pre-service student teachers. If the teacher is well prepared, the lesson will be a success. This can only be done if sufficient knowledge and skills are passed on. The knowledge and skills are being taught to the pre-service teachers in the module which this study focuses on.
Technology planning and leadership	At this stage, this module serves as an e-learning methodology. It is important to plan with other methodologies to see whether they do integrate technology in their modules and if they do, how or what they are teaching the students. This is important as content should not clash between various modules.
Cooperation within or between institutions	This theme of the conceptual framework is not covered in this study.
Feedback	Feedback can be given to students when they complete the formative assessment which asks them to design a learner centred e-resource. Students can make use of the resources which are demonstrated to them in their own context and they will have to identify and create their own resources for this assessment. These resources can be reused by them when they teach in their own classroom one day.
Collaboration	The formative assessment which students need to complete will be assessed by their peers anonymously on an online platform. Collaboration, in this instance takes place whereby the assessor (i.e. the students) will need to comment and give feedback on the e-resource which was created by their peers.
Authentic experiences	During class, the lecturers teach through example, whereby they demonstrate how technology can be integrated in the classroom. Students partake in this demonstration as a student in the classroom. Thereafter, the lecturer asks them to apply how they would use this resource if they were a teacher in the classroom. This is one instance where students will apply their knowledge regarding technology integration. The second instance will be when they apply what they have learn in the assignment.

Instructional design	This module focuses on two frameworks which the lecturers make use of and which are taught to the students. These are the TPCK framework and the backward design. Constructive alignment is also used as a strategy whereby the lecturers allow students to make their own meaning of a concept before giving them a detailed explanation of what it is about.
Reflection	Reflection takes place once students have completed the assessment task. This gives an idea of how they feel towards technology integration.
Role models	The lecturers convey content to students in such a manner that it can be used as a form of demonstration for these pre-service teachers of how technology can be integrated in the classroom.

Table 8 illustrates the themes of the conceptual framework along with how each theme is integrated in this study.

3.8 DATA COLLECTION

There are two instruments which will be used to gather data for this study. These include surveys which the students had to answer and a focus group interview with the lecturers of the module. The data collected correlates with the conceptual framework, meaning the data will be categorised according to the different elements on the conceptual framework. The summary below shows the different research questions which will be investigated during the study.

Table 9: The sub-research questions for this study with a key

Key	Sub-research question
SRQ1	How do lecturers view their role in preparing pre-service teachers for technology use?
SRQ2	How do students experience the implementation of technology use in their own teaching practice?

3.8.1 Focus group interview

A focus group is an interview tool used when a group of people/participants are selected and gathered to answer questions or give their opinion regarding a topic. It is an interactive environment where participants are free to discuss answers among each other. This interview strategy is based on the assumption that interaction among the participants will be useful due to the wide range of responses and recalling of certain details or experiences. Due to its interactive environment, participants can build on each other's ideas and comments. This will add depth to the interview and data derived from the interview (Maree, 2007, Yin, 2009).

3.8.2 Survey

A survey is an approach to gain information from the participants regarding their attitudes, ideas, habits, values and beliefs. It is usually associated with the deductive approach. Surveys are generally conducted when there is a large sample of participants. When a survey is conducted, many variables can be measured. It is typically used to describe a phenomenon or to draw comparisons regarding a particular topic (Maree, 2007; Mark et al., 2009; McMillan & Schumacher, 2010).

3.9 DATA ANALYSIS

The data analysis for the two instruments was done on its own keeping in mind the conceptual framework. The subthemes which were identified within each instrument were not the same. On some occasions, the subthemes have the same heading. However, the context in which it is discussed varies.

Within each instrument, themes, subthemes and premises were used. These will be explained in the table below:

Table 10: Definition of theme, sub-theme and premise for this study

Term	What does it mean during data analysis
Theme	The themes which were identified during the analysis process were the elements from the conceptual framework. Refer to table 8 to review these themes.
Sub-theme	The sub-themes within each instrument are exclusive to that instrument only. During the analysis process, data was separated according to repetitions or frequent occurrences of certain matters. These were grouped as sub-themes. Please note, on some occasions, the subthemes have similar or the same name, however, the context in which it is discussed varies according to the question asked.
Premise	A premise in this study refers to a high-level discussion of various subthemes which were identified in the study. It is a summary of two or more subthemes with a similar topic but discussed in different contexts.

3.9.1 Focus group interview

A focus group interview took place with the lecturers of the module. Questions regarding their teaching approach, support structure, teaching experience and modification of teaching were asked. The focus group was chronicled through a voice recorder. This data came in handy when the addressing the macro elements of the conceptual framework. The analysis process took place in eight 8 steps.

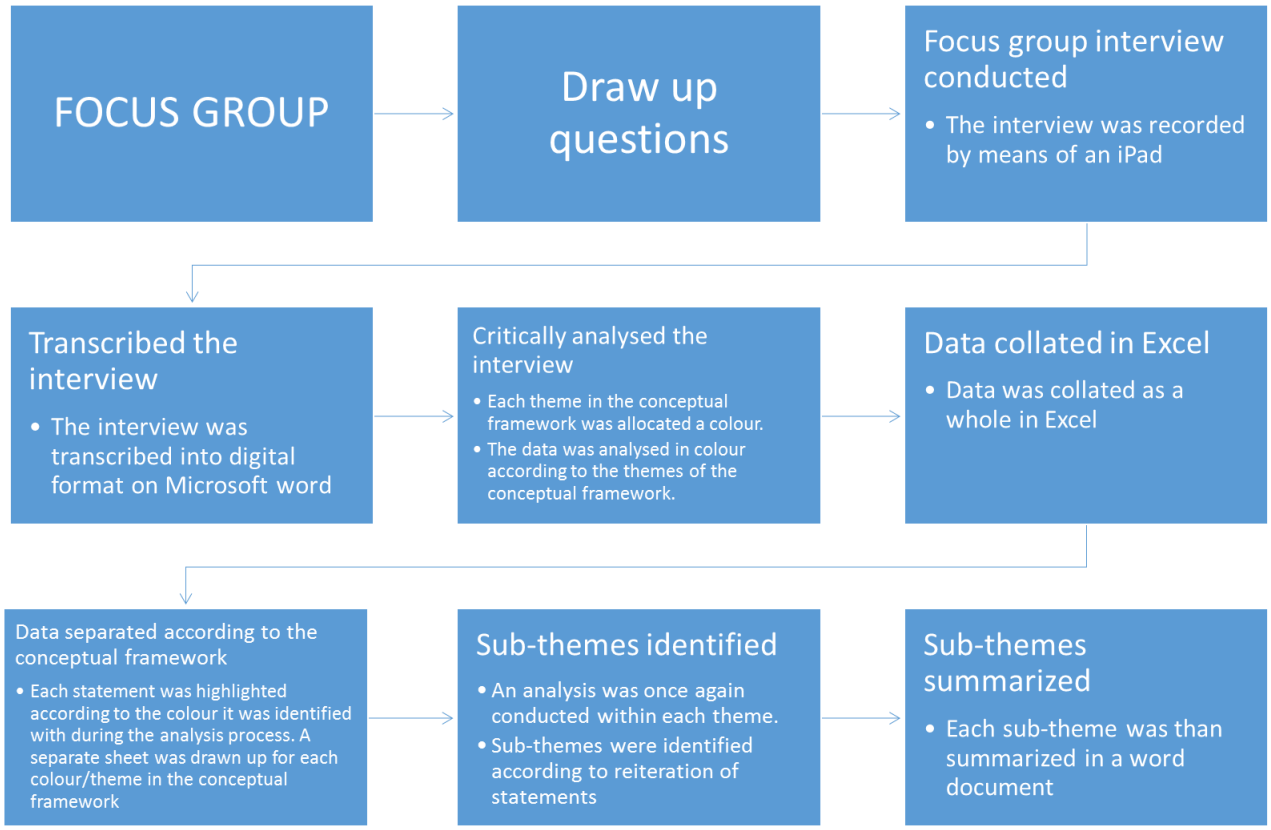


Figure 11: Focus group analysis process

Figure 11 illustrates the various steps in the analysis process of the focus group interview. Questions were drawn up according to the themes within the conceptual framework. The focus group interview was then conducted and recorded using an iPad. After this, the interview was transcribed into a word document. The interview was critically analysed according to the themes of the conceptual framework. The data was then collated into an excel spreadsheet and separated according to the themes of the conceptual framework. Within each theme, subthemes were identified. Lastly, each subtheme was summarised.

3.9.2 Survey

An online survey was conducted among the participants using the qualtrics software. Questions regarding students' experience of the module were asked in the survey. Various questions regarding the demographics of the group (e.g.," What is the phase and subject specialisation?") were asked. The questions in the survey were open-ended and participants were not bound to answer within a certain limit. All students did not have to complete the survey as participation was voluntary. Table 11 shows the questions which were asked in the survey.

Table 11: The survey questions

Key	Question asked in the survey
SQ1	What school phase are you focusing on?
SQ2	What subject field/s are you focusing on?
SQ3	Share the best apps/websites/resources that you found during your work on the OER pack. A name, URL and brief description will suffice.
SQ4	Describe positive experiences and lessons learnt during Theme three about the use of technology in education
SQ5	Share the challenges you experienced during your work on the assignment for Theme 3
SQ6	What did you learn through and about assessment/online assessment during the Peer Assessment process?
SQ7	Please share any other comments or ideas with us. Your valuable input is much appreciated

All the questions asked in the survey were not necessarily in the study. Questions 4, 5 and 6 were used in order to collect data (as highlighted above). The data analysis process consisted of six steps.

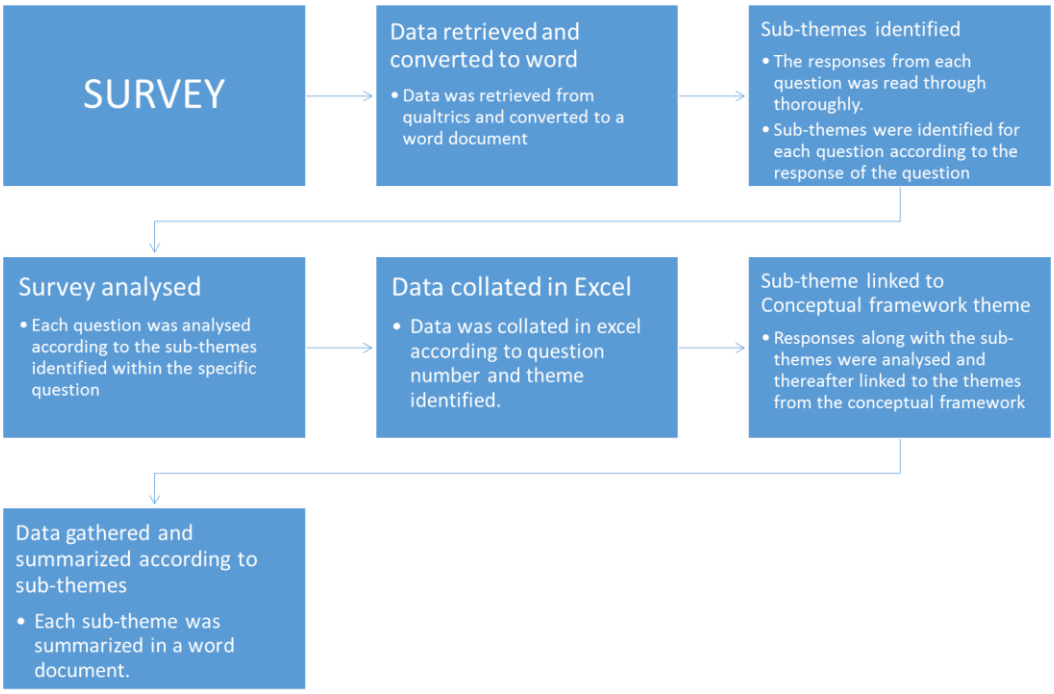


Figure 12: The analysis process of the survey

Figure 12 illustrates the data analysis process. Data was retrieved from qualtrics and after that converted to a word document. The data was read through question by question, and within each question, sub-themes were identified. Once the subthemes were identified, the response to each question was analysed according to the subthemes which were identified within that specific question. Thereafter, the data was collated in an excel spreadsheet. The subthemes which were previously identified were linked to the conceptual framework. Lastly, the data was collated and summarised according to the themes of the conceptual framework

3.9.3 Synthesis of focus group interview and survey

Once all the data was analysed for the focus group interview and the survey, the data was collated and summarised accordingly. The summarised data was then further analysed. The summary was tabulated along with the sub-themes which were previously identified. The statements in the table, along with the sub-themes, were carefully analysed, and premises were identified. Once the premise had been identified, it was linked to the themes of the conceptual framework. The data analysis for the combination of all the data took place in four steps, as depicted in Figure 13.

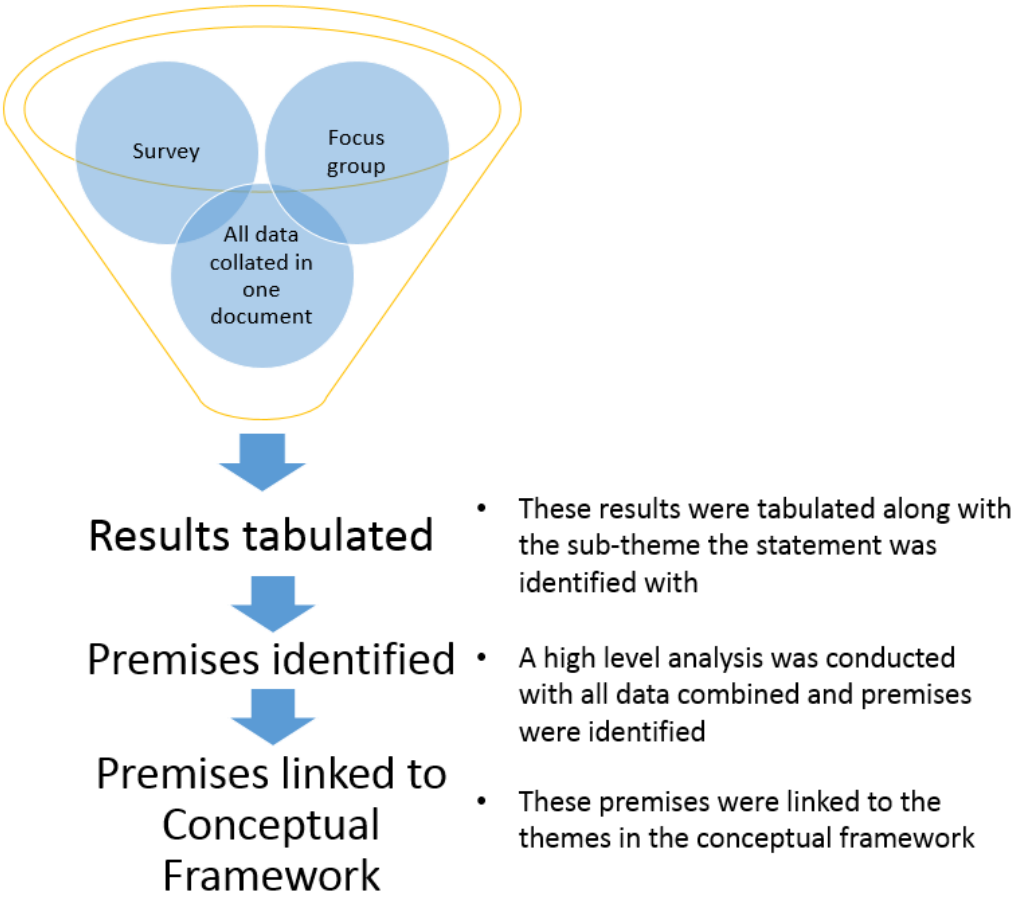


Figure 13: The analysis process of synthesis of all data

Figure 13 illustrates the analysis process of the synthesis of all data. Once the data has been analysed, a table was drawn up according to the themes of the conceptual framework. Within each theme, a synthesis was written up according to the findings of the data, along with the premise which been identified and the sub-themes linked to the premise.

3.9.4 Application within the conceptual framework

Table 12 shows the various themes within the conceptual framework, along with which research questions have been addressed with the theme and the data instrument used in order to address the problem being addressed. Refer to Table 9 to review the sub-research questions for this study.

Table 12: Instruments used to derive data as per themes of the conceptual framework

Key theme	Research Question addressed	Data collection instrument used
Access to resources	SRQ 1 SRQ 2	• Survey • Focus group
Training staff/ Staff development	SRQ1	• Focus group
Technology planning and leadership	SRQ1	• Focus group
Cooperation within or between institutions	N/A	N/A
Feedback	SRQ1 SRQ2	• Survey • Focus group
Collaboration	SRQ1 SRQ2	• Survey • Focus group
Authentic experiences	SRQ1 SRQ2	• Survey • Focus group
Instructional design	SRQ1 SRQ 2	• Focus group • Survey
Reflection	SRQ1 SRQ2	• Survey • Focus group
Role models	SRQ1 SRQ2	• Focus group • Survey

3.10 Population and sampling

The study has been conducted on the third-year students who were registered at the university and had to complete a compulsory core elective. The total amount of students in the group amounted to roughly 800 students. These students came from all walks of life. They varied in terms of socio-economic status, cultural background and experience with ICT.

As a form of assessment, students had to complete a three-part assignment. The first part included completing the assignment and uploading it online onto Turnitin; thereafter, the assignments which were randomly assigned to students for peer-assessing and thirdly they completed an online survey anonymously. This survey was available for students to complete online over four days, and participation was

voluntary. It did not count for any marks. A total of 201 students completed the survey.

3.11 Ethical aspects

Ethics are the rules or norms of conduct which differentiate between acceptable and unacceptable behaviour. When conducting research, we are dealing directly with participants in the form of collecting data. To protect the participants of the study, various ethical considerations need to be put in place. These include protecting the participant's identity and confidentiality. One has to gain permission from various stakeholders for research to be conducted (Creswell and Creswell, 2018, Maree, 2007).

Ethical clearance was obtained from the university and permission was granted by the dean for the research to take place. The participants in the studies were aware that if they completed the online survey, they would be partaking in a research project. Participation in completing the survey was voluntary for the students. This was discussed with participants in the class, and they were notified when they completed the survey. Their identity is protected at all times as no names, or personal information is disclosed within the research.

Students who participated in the interview and took part in the focus group discussion were made aware that they were being recorded and it would be used for research purposes. Once again, their identity was protected so that they will remain anonymous.

Participants within this study are aware that the work they presented, as well as the surveys they answered, are used for research purposes. All participants in this study were kept anonymous. Participation in this study was voluntary. Students had to sign consent forms to allow their feedback to be used for research purposes. Permission was requested from the dean of the faculty presenting the course to use data collected from the students for research and granted.

3.12 Trustworthiness

Qualitative research, due to the nature of the research, is usually imprecise., thus resulting in various techniques being used to improve the trustworthiness of the results. These techniques all have different purposes and different ways of determining whether the data analysis is trustworthy or not (Krefting, 1991, Maree, 2007). The trustworthiness of this study will be discussed by reviewing four aspects; namely, transferability, dependability, credibility and confirmability.

According to Krefting, transferability in research refers to when the findings of a study fit into a context from the study which “determines the degree of similarity or goodness of fit between two contexts” (Krefting, 1991). The key factors in the transferability of data are the informants of the group. Additionally, the data should take priority over the subjects of the study.

Transferability is applied in this study as the data analysis process was guided by the conceptual framework (refer to Chapter 3, Section 3.7, to review the conceptual framework). The data derived for this study was obtained from two instruments; a focus group interview conducted with the lecturers of the module and a survey which the students had to complete. The data collected for this study was analysed according to the themes of the conceptual framework.

Dependability in research refers to how consistent one is regarding one's findings. Because qualitative data is based on multiple persons’ experience and not only just one person’s experience, data must be analysed consistently. The method in which one analysed data should be described in detail (Krefting, 1991).

Students were asked to answer a survey which consisted of open-ended questions. These students completed the module on which this study was based. The questions which were used from the survey in this study were all analysed in the same way. Each question, along with its response was read through, thereafter sub-themes were identified (N.B. each question had its own set of sub-themes). The sub-themes were then linked to the themes of the conceptual framework. Refer to Section 3.9.2 for a more detailed analysis.

Credibility according to Lincoln and Guba (1985) is when a researcher establishes “confidence in the truth of the findings” for the participants and the context of the study (Krefting, 1991). It is said that a qualitative study is deemed credible when the researcher's description of the real-world experience is so accurate that if someone else, in the same context as the participant, had to read the description, they would be able to relate to it. An important criterion in the credibility of one’s analysis is the identification and documentation of recurring themes (Maree, 2007).

For this study, the themes of the conceptual framework guided the analysis process. However, on some occasions, sub-themes were identified, and these sub-themes were then linked to the themes of the conceptual framework. Sub-themes were identified separately for the focus group interview and the survey. Some of the sub-themes share the same name. However, the context in which it was identified differed. These sub-themes were identified as a result of recurring topics within the response of the students in the survey and the response of the lecturers in the focus group interview.

Confirmability can be described as the neutrality of which the findings of a study are shaped. The findings should be shaped by the participants of the study and not the biases of the researcher (Krefting, 1991). The confirmability of a study can be augmented by the concept of triangulation. Triangulation is using multiple methods of gathering data “to investigate the same phenomenon”. If a researcher combines more than one method of collecting data, a researcher gets a “complete array” of themes or symbols derived from a theoretical concept (Maree, 2007).

Data for this study was collected using two instruments, viz., a focus group interview conducted with the lecturers of the module and a survey which students had to complete. The data analysis process was guided by the themes of the conceptual framework for this study.

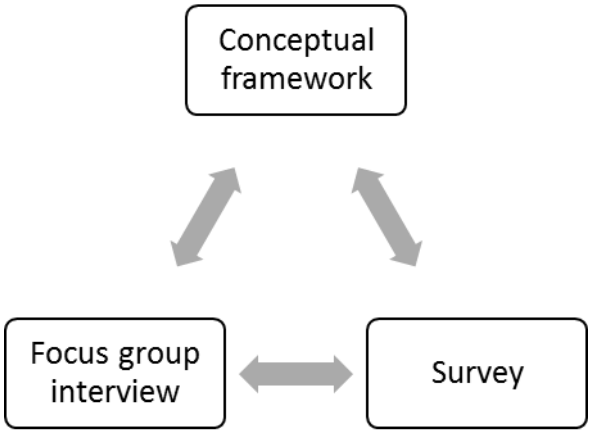


Figure 14: Triangulation as applied for this study

Figure 14 illustrates triangulation as applied to this study. Each data instrument was analysed independently and then as a whole. The focus group interview was analysed according to the themes of the conceptual framework. After that, sub-themes were identified within each theme. These sub-themes were then summarized.

The survey consisted of seven questions, however only three questions were used for this study. Each question, along with its responses, was read. Within each question, sub-themes were identified. The sub-themes were then linked to a theme in the conceptual framework. Once this data was summarised, it was combined with the summarised data of the focus group interview. The combined data was further analysed, and premises were identified. Once the premise was identified, content under each premise was analysed. These premises were then linked to the themes in the conceptual framework.

Due to this study being an interpretivist study, the researcher previously adhered to the seven principles of hermeneutics. The seven principles of hermeneutics assist the researcher in understanding the thoughts and actions of humans in an organisational and social context. Furthermore, it produces insight into information regarding the management and development of information systems (Klein & Myers, 1999). The seven principles of hermeneutics were found to be similar and link to the concepts of comparison to credibility, transferability, dependability and confirmability. The application of the seven principles of hermeneutics for this study can be found in Table 7

3.13 Conclusion

The chapter consisted of the research design along with the data collection, data analysis, ethical considerations and trustworthiness of this study.

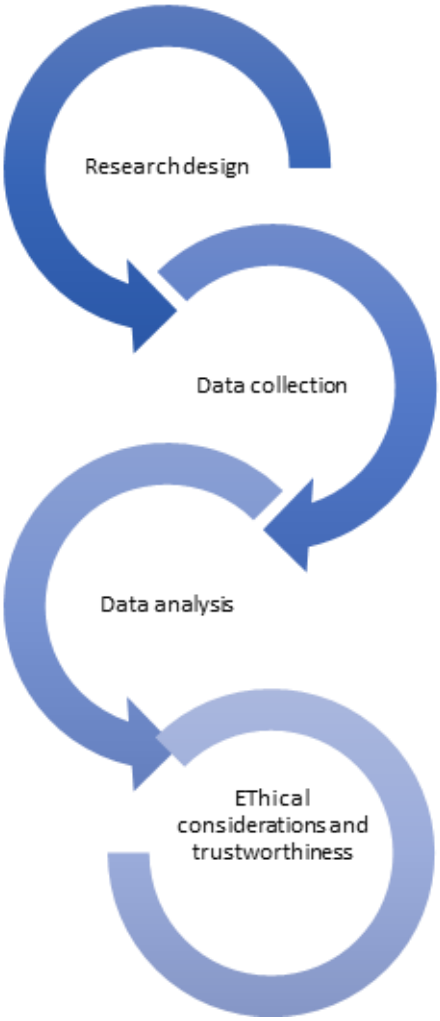


Figure 15: Chapter 3 as illustrated

Figure 15 illustrates how the above chapter is unpacked. The research methodology is guided by the research onion created by Mike Saunders. The strategy which this study has undertaken is an exploratory case study. It is deductive and follows an interpretivist approach. Data were collected using two instruments, viz., a focus group interview and a survey. The data analysis was guided by the conceptual framework of this study, which is the SQD model. Furthermore, the ethical considerations and trustworthiness of the study are also discussed.

The next chapter will focus on the analysis of the data for this study. It includes the analysis process of each instrument as well as the results and a synthesis of the data collated.

4. CHAPTER 4: DATA ANALYSIS AND RESULTS

4.1 INTRODUCTION

Results for this study were collected from two instruments; a focus group interview with the lecturers of the module and a survey which was completed by the students. The process followed to get to the results of the study was parallel, except on one occasion. This will be discussed below in the process of how each instrument was analysed and then combined. The definitions of theme, subthemes and premises can be found in Table 10 in Chapter 3.

4.2 FOCUS GROUP

A focus group interview was conducted with the former lecturers of the module. Two lecturers took part in the focus group interview. Questions regarding the module were centred on the themes of the conceptual framework.

4.2.1 Analysis process

The analysis process for the focus group interview took place in eight 8 steps

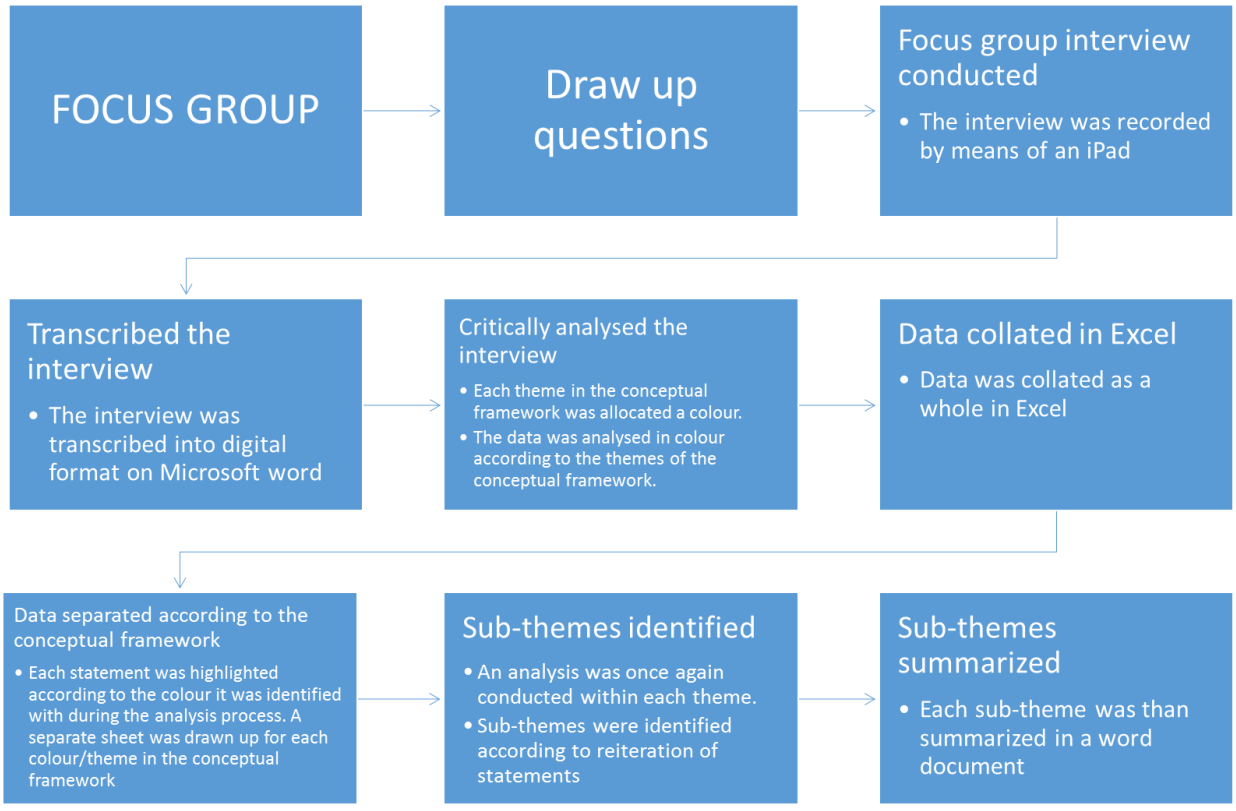


Figure 16: Analysis process for focus group interview

Figure 16 illustrates the steps which were taken during the analysis process for the focus group interview. The steps will be discussed in more detail below.

4.2.1.1 Step 1-2: Draw up questions and conduct focus group interview

Questions for the focus group interview were drawn up based on the Conceptual Framework of this study. Refer to Appendix B to view the questions asked. The data was recorded using an iPad.

4.2.1.2 Step 3: Transcription of the interview

Once the interview was conducted, the transcription process started. The interview was transcribed into a word document.

4.2.1.3 Step 4: Critical analysis of the interview

Before conducting the focus group interview, a high-level description of each theme was deduced based on the literature found. This description can be found in Table 1 in Chapter 1. Thereafter, each theme in the Conceptual Framework was colour coded.

Theme	
Instructional Design	
Role Model	
Collaboration	
Feedback	
Authentic experience	
Reflection	
Access to resources	
Technology planning and leadership	
Training Staff	
Preparing pre-service teachers for technology use	

Figure 17: Themes of the conceptual framework colour coded

Figure 17 illustrates the different colours used to identify statements in the focus group interview. Each statement was read carefully and colour coded according to the theme which it fitted in. The interview was analysed according to the themes of the conceptual framework.

Each statement was critically analysed through colour coding (refer to Figure 17), according to a theme or in some cases, themes of the conceptual framework. This is an example of how the focus group interview was analysed.

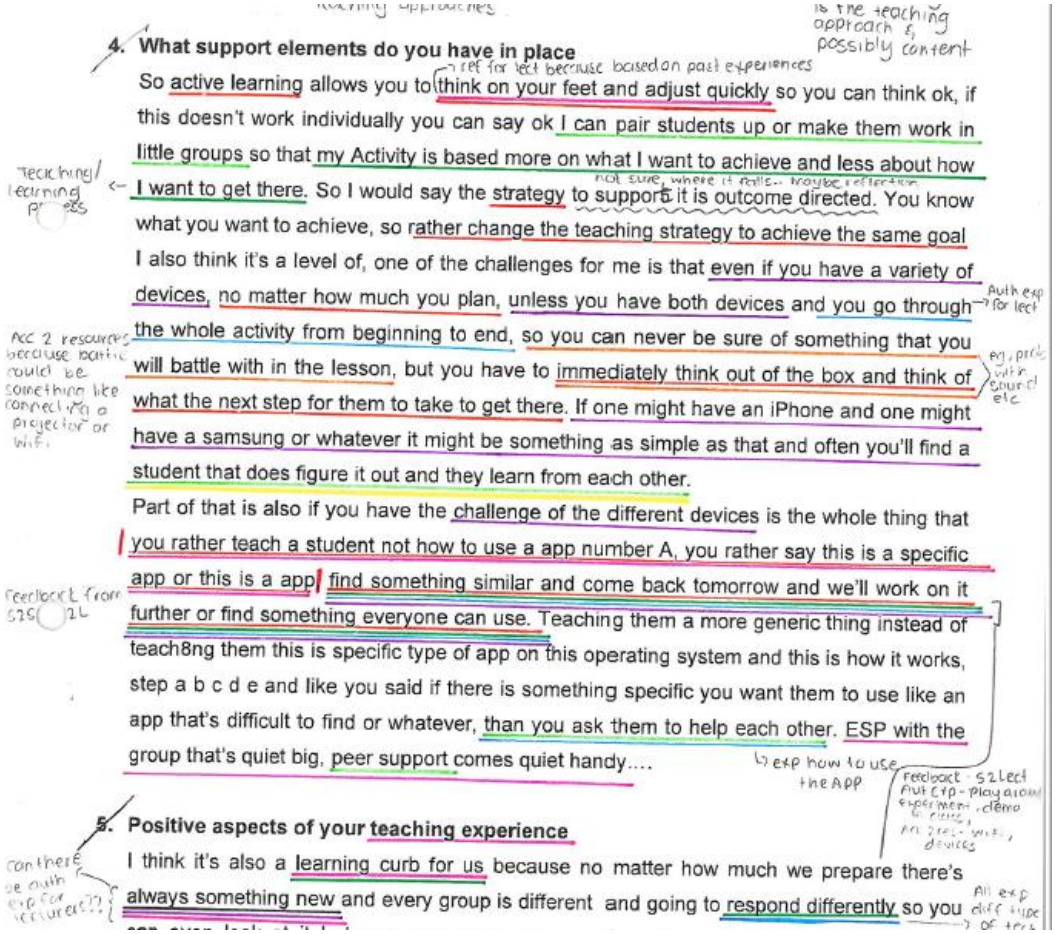


Figure 18: Example of the analysis of the focus group interview

Figure 18 is an image of how the focus group interview was analysed. Each statement was critically analysed and colour coded according to which theme it fits in within the conceptual framework. Additionally, notes were added to justify why it fitted in the theme identified.

4.2.1.4 Step 5: Data collated in Excel

Once the analysis was completed, the data was collated in an excel spreadsheet as per the colour in the conceptual framework (refer to Figure 17). The data was collated according to the themes in the conceptual framework.

Phrase	Theme	Justify
What teaching strategy or teaching approach did you use in your class?		
"A very learner centred approach, very interactive and very engaging"	Instructional Design	Lecturers explain the various teaching approaches. It gives insight as to how they structure their lessons. From this statement we can determine that the class focuses mainly on a learner centred approach.
"Interactive and very engaging"	Collaboration	Interactivity takes place among the students as well as between the students and lectures. This is in the form of sharing ideas as well as feedback
"Discussions"	Collaboration	Discussions about the content as well as sharing ideas of how it could be used in a classroom setting. this was done among students as well as between students and the lecturer as a form of a class discussion
"A bunch of activities"	Instructional design	Lesson was planned to include activities linked to the content being taught during the lesson
"So the students were more busy"	Instructional design	Lesson was planned in order to keep students occupied
"So the students were more busy"	Collaboration	The term "occupied" in the above statement means students could be busy doing an activity on their own or in a group or discussions could have taken place regarding what was being taught in class
"so a lot of active learning"	Instructional design	Learning approach chosen or preferred regarding the content which needed to be taught

Figure 19: Data collated in an excel spreadsheet

The above figure (Figure 19) illustrates how the data was collated in an excel spreadsheet. The first column indicates the statement from the focus group interview along with the colour which it fits in within the conceptual framework. The second column indicates the theme which it fits in within the conceptual framework and the third column is a justification as to why the statement fell in the particular theme.

4.2.1.5 Step 6: Data separated according to themes in the conceptual framework

Once all the data was collated, each theme was allocated to its own excel sheet. Data from the particular theme was placed under its correct sheet.

4.2.1.6 Step 7: Sub-themes identified

The data collected was read through thoroughly; thereafter, sub-themes were identified within each theme (Refer to Appendix).

The sub-themes were identified through reiteration of statements in the focus group interview. Statements were than plotted in these sub-themes identified in an excel spreadsheet.

		Teaching strategies	Students engaged/involved	Resources
"A very learner centred approach, very interactive and very engaging"	Instructional design	X	X	
"A bunch of activities"	Instructional design		X	X
"So the students were more busy"	Instructional design		X	
"so a lot of active learning"	Instructional design	X		
"way you present a lesson"	Instructional design	X		
"I can't say it's because of the learner centred approach"	Instructional design	X		
"active"	Instructional design		X	
"I were to use a more learner centred strategy"	Instructional design	X		
"I think it's a very guided approach"	Instructional design	X		

Figure 20: Identification of sub-themes as per conceptual framework theme

Figure 20 Illustrates the excel spreadsheet as separated by the themes of the conceptual framework. Within each theme, subthemes were identified. Statements form the focus group interview were once again analysed and plotted within a subtheme as illustrated above.

A table was drawn up with the themes from the conceptual framework and the subthemes identified. In some cases, subthemes were repeated

Subthemes identified in Focus Group Interview	Technology planning and leadership	Cooperation within/between institutions	Training staff	Access to resources	Role models	Feedback	Authentice xperience	Collaboration	Instructional design	Reflection	Preparing PST for tech use
Teaching strategies					x				x		
Studnets engaged/involved									x		
Resources									x		
Alternatives					x						
Sharing among each other								x			
Peer support								x			
Lecturers and students								x			
Students response						x					
Lecturer benefits						x					
Students benefits						x					
APPS/Resources				x			x				
Demonstrations							x				
Based on students- Positive										x	
Based on students- Negative										x	
Lifelong learner										x	
Teaching strategies										x	
Devices				x							
Availability of resources	x										
Challenges	x										
Lecturer			x								
Module			x								
Outcome											x
Content											x

Figure 21: Sub-themes plotted against the themes of the conceptual framework

Figure 21 illustrates the themes along with the sub-themes identified within the focus group interview.

4.2.1.7 Step 8: Sub-themes summarised

Each sub-theme was than summarised in a word document.

4.2.2 ANALYSIS OF DATA AS PER CONCEPTUAL FRAMEWORK THEME

The analysis of data for the focus group interview is structured according to themes from the conceptual framework. Each theme was separated, and sub-themes were identified within each theme.

4.2.2.1 Instructional design

This theme deals with the various teaching strategies and theories which are implemented by the module coordinator and other lecturers to support the integration of technology and teaching. The following subthemes were identified for instructional design: teaching strategies, students engaged/involved and resources.

a. Teaching strategies

The sub-theme of teaching strategies is identified as lecturers placed a lot of emphasis on the various strategies which they used to teach the module. Lecturers made use of the learner centred approach and active learning. Apart from only teaching using these strategies, they wanted to demonstrate to students how these strategies could be used in a classroom when integrating technology in a lesson. The two lecturers who took part in the interview mentioned that they did not use the same teaching strategies in each class. They would use and demonstrate these strategies according to their personal preference or when they felt it appropriate. As one interviewee put it, “Technology integration isn’t just apps, so we have lots of variety of teaching methods so you choose the most applicable or appropriate type of technology when you design this lesson”.

Along with demonstrating the various teaching strategies, various APPS and resources were also demonstrated to students in a way which could be used in a classroom. A respondent of the focus group interview mentioned that they liked to “teach through example”. This is highlighted thoroughly in the focus group interview. Data revealed that the module is centred on active learning and learner-centred learning. Lecturers encouraged students to engage in class by interacting with the

content presented to them or making discoveries regarding finding new APPS or resources.

It is mentioned that this module was presented over a short period (6 weeks to be more precise). Respondents indicated that this module varies in terms of its teaching approach as compared to other modules. Lecturers needed to have an approach where “You have to be very convincing; you have to sell it basically”. This was seen as a challenge due to time constraints. “Part of the active learning approach and the whole interactive-ness is to get them to trust you enough so that they can interact.”

The matter of “finding alternatives” is also mentioned. Talking about this issue, an interviewee said “no matter how much you plan, unless you have both devices and you go through the whole activity from beginning to end, so you can never be sure of something that you will battle within the lesson, but you have to immediately think out of the box and think of what the next step for them to take to get there.”. Due to the fact that one is using technology, it is inevitable that one will experience a technological malfunction at some point, although this is not always the case. Despite that, one has to be prepared for an alternative in order to carry on with the lesson. As one interviewee put it, one needs to “think on your feet and adjust quickly.”

b. Students engaged/involved

Due to the module being centred around using an active learning and learner-centred approach, student involvement is a crucial element. Coupled with interacting in class by completing activities and sharing their work with the class, students were also asked to share various APPS and resources which they found and thought might be useful to others.

Lecturers would show students a certain APP and ask students to go out and find something similar or better and share it with the class. This forms part of experiential learning. Learners were encouraged to go out and learn how to find APPS and resources and use them in a classroom. For example, one interviewee stated, “It’s only when they experience it do themselves do they understand the value of it”.

Apart from students developing trust and sharing their ideas and discoveries with the lecturers, the lecturers had to be open to the idea of learning from the students. With technology developing at such a rapid pace, one has to be open to the idea of learning from others; even if it was from your students. Lecturers can see this as a form of feedback.

For students to feel comfortable sharing their discoveries with the lecturer and the class, the lecturers needed to build trust with the students. In this way, students would feel free to share their ideas and findings with the lecturer and the class. An interviewee mentioned that "Part of the active learning approach and the whole interactive-ness is to get them to trust you enough so that they can interact."

Another way in which students were directly involved in the module was through peer assessment. Students were asked to complete an assignment and submit it online. After that, they were asked to each mark four assignments using an online system. This allowed for students to learn how to mark online.

c. Resources

The use of technology in an educational context was greatly encouraged throughout the module. Students were taught, demonstrated to and even asked to find resources or online applications which they could use in a classroom when they teach. An interviewee mentioned that "Presentation for students to use on their own for them to research, for them to interact with games and apps, for them to find games and apps, so I support tech use."

4.2.2.2 Role model

The lecturers and subject experts acted as role models as they were conveying content knowledge and skills to students. The following subthemes were identified under "role model": teaching strategies and alternatives.

a. Teaching strategies

The data under the sub-theme "teaching strategies" was analysed from a student's perspective and a lecturer's perspective.

Lecturers mentioned that the nature of the module allowed various teaching strategies to be used. These teaching strategies are taught to students and also demonstrated to them in the class. Lecturers presented their classes in a way which they hoped their students would also present while making the most of the resources available to them. As mentioned by lecturers in the interview, “we model what we want them to do” and “I present my lectures the way I want them to present”. Lecturers did not only teach a concept; they demonstrated it as well.

Lecturers mentioned that students might only have the experience of their school teachers and the methods they used. Students needed to be exposed to new teaching strategies and methods of teaching using different resources, more specifically, technological resources. An interviewee mentioned that “they model what you do and the only knowledge they have is of the teachers they have at their school”. If students are exposed to teaching with the integration of technology, they might use it in their teaching practice.

b. Alternatives

Students were exposed to various teaching strategies which could be used with or without the integration of technology. Additionally, they were also exposed to teaching with technology from a student’s point of view and an educator’s point of view. For example, if students are asked to download an application, they will use it from a student’s point of view in the class while the lecturer will use it from the teacher’s point of view, hence students are getting the feel of what it is like using it as a teacher and a student. As pointed out in the interview “you have to first let them see how it works from different angles”. A lecturer mentioned that they tell the students that “I’m going to teach you the same content integrating technology.”.

When using technology, at times, one might come across a technical malfunction. It is important to show students that despite the malfunction, one can continue using technology. There is always an alternative available. Lecturers mention that they “show them the flaws and how it can be fixed”. Lecturers plan to incorporate the flaws only to show students that it can be fixed and show students how to do so.

In addition, lecturers mention that students do not make use of technology while teaching because they do not show confidence when using technology. This module shows students how to prepare for technology integration as well as make use of it in the classroom. Lecturers try their best only to let students see the positive when integrating technology in the classroom. If students can “understand the value” and see how easy it is to use technology, they might be “confident enough to actually use it”.

The module has a blended approach to it. If something happens to occur with a technological device, lecturers are still able to continue teaching. There are lessons which students can learn from the fact that even though something might not work, the lesson can go on without the device or, an alternative is available.

4.2.2.3 Collaboration

Collaboration among students is important as well as between students and lecturers. It provides opportunities to share ideas and concerns and participate when necessary. This includes the face-to-face classes as well as the learning management system. The following subthemes were identified under the theme of collaboration: sharing among each other, peer support and sharing between lecturers and students.

a. Sharing among each other

Collaborating goes beyond working together; in this case, it also means sharing among each other. This involves sharing various apps and resources found, which could be useful in education. However, it goes beyond sharing apps and resources; it is also sharing knowledge or showing someone how something can be done. Students learn from lecturers, and in some cases, they also learn from each other.

Lecturers make it a point of allowing for platforms to be open whereby students can share their findings. As one respondent mentioned, it is a case of “we teaching them to share their knowledge with each other”. Along with sharing among each other, you are also learning from others.

With a bewildering number of apps and resources available, one can never know enough of what is out there. Sharing makes it easier for the students to find what they want, and it allows them to discover what else is out there. Furthermore, lecturers can also learn from what the students share among each other. The lecturers need to inculcate the skill of lifelong learning, especially with the technology aspect of the module. As mentioned by an interviewee, one needs to be "open enough to the student's response so you can learn from them". Lecturers can learn more of what's available out there based on students' feedback.

b. Peer support

Peer support is students assisting each other by sharing their knowledge or experiences with their classmates. This can occur on-campus or off-campus, during class or on another learning platform (for example, an online discussion group). It can occur when helping to show how something works, explaining a concept or working together to figure something out. For example, students are given a task of working with an app in class; some students might figure it out quickly, while others might find some difficulty in grasping how the app works. Students will naturally turn to another student first to seek assistance before asking the lecturer for assistance. As mentioned by an interviewee, it is a case of "A student that does figure it out and they learn from each other".

c. Lecturers and students

Lecturers and students collaborate in class through discussions, sharing of information and asking for assistance. In some instances, collaboration also occurs when the lecturer shares what the students have introduced. Lecturers mention that they are open to the idea of sharing ideas and apps which students bring to the class and even learn from them. This, however only occurs if the lecturer is "being open enough to the students response so you can learn from them".

Collaboration also occurs between the lecturer and the tutor. Students turn to the tutor for assistance in some cases. The tutor will then assist them and provide feedback to the lecturers regarding areas with which students are struggling.

4.2.2.4 Feedback

Feedback assists both the students and the lecturers. It assists students by providing insight regarding what they can change or improvise on. It assists lecturers as a form of guidance regarding the design of the module. The following subthemes were identified under the theme of feedback: students' response, lecturer benefits and students' benefits.

a. Students response

Feedback, in this case, is for the lecturers' use. For students, feedback is only beneficial in a learning context. However, for lecturers, feedback is valuable in a teaching context as students' response steers lecturers to see if their teaching strategies are working, and if students understand the content which is being taught.

b. Lecturer benefits

The response from the students can benefit the lecturers greatly. Furthermore, lecturers need to keep in mind that they are lifelong learners. Lecturers can benefit from students' response in terms of "developing and revise teaching for next time". Along with that, lecturers need to keep an open mind when receiving feedback from students. As mentioned by an interviewee, one needs to be "open enough to the students' response so you can learn from them". Students' response is not always just answering a question in class, but also coming to you as the lecturer with a suggestion about an app or resource which they might have discovered. Lecturers, in turn, need to be open to the ideas of students and be willing to learn from them, especially with the nature of the module.

The tutor's feedback to the lecturers is also beneficial. Students attend the tutorials, and in some cases, they might express their concerns regarding the module or teaching strategy or a concept with which they are struggling. Tutors then communicate this to the lecturers who would make changes if necessary. As mentioned by an interviewee "you receive feedback from the tutors in terms of what's working or not".

c. Students benefits

As mentioned by an interviewee, this module “throws learning into the hands of the students”. Students are encouraged to play around with various apps and resources. This allows students to see what is out there for them to use. Each student comes from a context where they were exposed to teaching differently. This module makes use of or is focused around learner-centred learning. Lecturers present the module by “teaching through demonstration”. This allows students to see how something is done and how it can be applied in a classroom situation. Furthermore, students are sometimes guided towards making a mistake (by the lecturer). This is done so students can learn from their mistakes and see how easy it is to rectify a mistake.

Students also benefit by learning from each other. This is accomplished through discussions and interaction in class and also through the peer assessment process. Students are exposed to other students’ work and see what they produced. It allows them to open up their mind to new ideas and also reflect on their learning. Apart from learning from other students’ work, students are also being exposed to the online marking process.

4.2.2.5 Authentic experience

Authentic experience comes in the form of learning through example or via demonstration, whereby students can see how resources can be utilised as well taking part in the demonstration of these resources. The following sub-themes were identified under the theme of authentic experience; APPS/resources and demonstrations.

a. APPS/Resources

The module involves using and finding various apps and resources that could be used in an educational context. Students, in some cases, are asked to download apps and resources which will be used in class. Some of these apps/resources, depending on the type of resource, have a teacher’s and student’s view. This allows students to see how these apps and resources “works from different angles” and how these can be applied in class.

Students are encouraged to go out and find apps/resources. Students are given criteria, or in some cases, they are asked to find something “similar” or “find something everyone can use”. This allows students to discover what is out there for them to use and “play around and see what value it has”. The apps or resources which students find are usually shared in class by the lecturer. In some instances, the lecturer allows all the students in class the play around or see what the functionality of the app/resource is. Lecturers are open to the idea of learning from their students and sharing what others have found. As mentioned by an interviewee “if a student comes up with something, then we all look at the app”.

Lecturers noted that some students have a better understanding of technology than others. Normally those who have a better understanding help the others by showing them how something works. Additionally, students had the opportunity to experience online marking. They were asked to assess and comment on an assignment which all students had to submit.

b. Demonstrations

The module is taught using various teaching strategies applicable to students, from a theoretical point of view and also by demonstrating to them in class. As mentioned by an interviewee, “I present my lessons the way I want them to present”. Lecturers are trying to get students to adopt new teaching strategies, and they are taught how this can be done with the aid of technology. Students are also shown various types of content which can be used for teaching with and without the aid of technology. Lecturers say they teach using “an example if something is done in a normal teacher-centred way and then say ok I’m going to teach you the same content integrating technology”.

In this way, students can see how technology can benefit students and make a difference in a lesson. The module is designed in a way where one can “demonstrate everything that is in theory”.

Students are shown how various apps and resources can be used in an educational context. Where possible, students are shown “teachers’ and learners’ perspectives” of an app or resource. In this way, students can see how the app works from a

teacher's point of view and what the experience is like using an app from a learner's point of view.

Along with teaching students how to use technology, students need to learn how to plan for using technology in a classroom. This is also demonstrated to students in class. Additionally, the assignment which students had to complete required them to plan a lesson integrating various technological resources. Students are also shown the flaws which come with technology, in terms of technological malfunctions, as well as planning for teaching by integrating technology. An interviewee mentioned we "show them the flaws and how it can be fixed".

4.2.2.6 Reflection

Reflection among students as well as lecturers is important. It allows one to review the effectiveness of one's skills and embrace change if necessary. Students can reflect on their learning, while lecturers can use reflection and see how the module can be adapted for future use. The following subthemes were identified under the theme of reflection: based on students- Positive, based on students- Negative, lifelong learner and teaching.

a. Based on students- Positive

The lecturers noted that students' reaction was positive, however, this does not guarantee that it was because of the teaching approach used. Since the students were engaged in exploring content and resources and asked to "discover it themselves", it could be that the students' reaction was positive as they were intrigued by what they were learning.

b. Based on students- Negative

Some of the students experienced the teaching approach used in this module for the first time. This caused uncertainty among them as to whether they would be learning something or not. In this regard, an interviewee mentioned: "if you say you are not going to have this teacher talk kind of lecture we are going to now have this interactive learner-centred technology-based lecture, they scared, they feel like they are not learning something because it is something they are not familiar with".

Because of this, the lecturers' plan for students to "be more responsive" is new to the students; they do not know how to react or respond in certain scenarios.

With technology, there is the factor of those students who own a device that is not compatible with what is being done in class. Hence, lecturers face the problem of students' "inability to use or source information using their own devices". Students then have to share with peers or only observe how something can be used and not take part in what is being done.

One of the aims of the module is to demonstrate to students how easy it is to integrate technology in a lesson. It is expected of students to know the basics of using technology. However, lecturers noted that some students battle with just the basics. If students have confidence in something, they will use it. However, with technology, an interviewee mentioned "they are not confident enough", hence "they are not going to use it".

c. Lifelong learner

The nature of technology is that there is always going to be something new out there, whether it is a device or an app. Lecturers realise this by acknowledging that they need to be open enough to student's response so they can learn from them. An interviewee mentioned that "we don't go on assuming that we know everything". If lecturers display this attitude in the class, students will be more open towards sharing their discoveries. Apart from learning something new in terms of technology, lecturers can take the feedback to heart and revise their teaching for next time by improvising if needed

d. Teaching

With teaching any lesson, one needs to be well prepared. When planning for teaching with technology, one not only needs to be well prepared, but every last detail needs to be put hrough a trial run before being presented to students. Interviewees commented on everything in their planned lessons: "tried out myself from the teachers' and learners' perspective just so that I am sure of how everything works". Additionally, one should try and plan for an alternative in case something goes wrong. As mentioned, one needs to "think on your feet and adjust quickly".

Teaching goes beyond being well prepared for a lesson. Lecturers model how they want students to teach in a classroom one day. One needs to pay close attention to the way you present yourself, the words that you use and the attitude you have towards the class. One needs to grab students attention, especially when students are unfamiliar with the teaching styles; hence one needs to be “very convincing. You have to sell it basically”.

4.2.2.7 Access to resources

This refers to the hardware and software resources available in the University to support the integration of technology in teaching, such as access to the Internet, Wi-Fi, the Learning Management System. The following subthemes were identified under the theme of access to resources: devices and APPS/resources.

a. Devices

The university supports the use of technology integration; hence, the lecturers are equipped with devices necessary for technology integration. Additionally, the lecture halls are also equipped with “visualizers, projectors and the computer which you can connect anything to, so in terms of hardware and software, everything is available”. In some cases there are challenges where equipment doesn’t work, however in other cases (depending on the venue of the lecture), there are alternatives available.

There is a challenge with the “variety of devices” among students. Every student has a different device with a different operating system. Students are left to figure out if what is being discussed in class is compatible with their device or not. In terms of Wi-Fi, “there is Wi-Fi access everywhere”. Having access to download content should not be an issue for students

b. APPS/Resources

As part of the module, students are introduced to various online resources such as apps, websites etc. They can use these resources as learning and teaching material during their teaching. Students are given criteria and asked to look for an app or resource which meets the criteria. This allows students to “play around” with what is available and discover what is out there for them to use. This also allows students to “experience” finding an app or resource which can be used in an educational

context. Students are, in some cases, asked to share their findings with the class. This doesn't only teach them to share their findings, but it also shows them how many options are out there. Lecturers are open to the idea of sharing the findings of the students. As mentioned by a participant "there is always something new for us". This refers to the variety and quantity of online resources available.

4.2.2.8 Technology planning and leadership

The Information Technology Services (ITS) Committee of the university provides the various hardware and software needed for effective teaching and learning to take place. Education innovation is a unit at the university which encourages and supports lecturers in the integration of technology in education. The Deputy Vice-Chancellor Academic supports and encourages the integration of technology in education. The following subthemes were identified under the theme of technology planning and leadership: availability of resources and challenges.

a. Availability of resources

The university strongly encourages the use of technology integration when teaching. Lecturers are provided with the necessary materials for personal use and in lecture venues. As said by a lecturer: "in terms of hardware and software, everything is available". Depending on the lecture venue, the equipment differs. As mentioned by a lecturer, the newer lecture venues have "visualizers, projectors and the computer which you can connect anything to". Along with state of the art equipment, the new venues include plug points so students can "plug in their laptops and charge their phones in there".

b. Challenges

With the use of technology, one needs to be prepared for an alternative in case a technological malfunction occurs. If this does occur, one needs to "immediately think out of the box" and find a quick solution. Because the university supports the use of technology, some of the lecture venues cater for an alternative. As mentioned by a lecturer: "the venue is so big there are two projectors, so if one is broken, you can still continue on the other side".

4.2.2.9 Training staff

This theme refers to what the university does as an institution to keep lecturers up to date regarding educational technology. Additionally, this theme also relates to how the university supports this development of knowledge. The following subthemes were identified under the theme of training staff: lecturers and the module:

a. Lecturers

With the information overload we experience, there is always something new waiting to be discovered. Whether it is a device, programme, app or a website, as a teacher, you need to be a lifelong learner to succeed and educate future teachers. This is only possible if there is a good support structure in terms of those working alongside you in terms of lecturing the module.

An interviewee mentioned that there is a “whole structure which supports you quite well”. Structure refers to all the people involved in the module itself; namely, the module co-ordinator and lecturers. Everyone works together to find content to teach and train on how it can be taught using the latest technology available and making use of all resources available in the lecture venues provided by the department.

b. Module

The module which is being studied has been “designed in a modular way”. It is sub-divided into smaller parts. The module was designed in this way, and to a certain extent, it is lectured that way as well. The module has been designed in such a way to demonstrate what is being taught to learners.

4.2.2.10 Preparing pre-service teachers for technology use

This theme refers to the content of the module, the outcomes which students need to achieve as well as the skills and knowledge needed to succeed in this module. The following subthemes were identified under the theme of preparing pre-service teachers for technology use: outcome and content.

a. Outcome

The main outcome of the module, as mentioned in the study guide, is that students should be able to identify, evaluate and apply various aspects of technology, including educational resources, in a responsible manner in teaching practices, to support the development of appropriate 21st-century skills. The content of the module is made up of “chunks which help you to get to a huge outcome”. The big outcome is to guide students into implementing and using technology in teaching that will support the development of values and skills that learners need in the current era. Students are exposed to various teaching styles and resources which they can implement and use in their classroom. Various theories and teaching strategies, as well as core concepts of technology for 21st century education, are taught and in some cases, demonstrated to students.

b. Content

This module is an “interactive technology-based module”. The content of the module is broken down into six themes. Each theme covers a different aspect of teaching with technology. The content includes planning for teaching with technology, teaching strategies, assessment using technology, e-resources and core concepts regarding technology integration in education.

4.3 SURVEY

The survey was conducted before the study. It was completed at the end of the semester in which the module was taught. The survey was voluntary and anonymous. Students were asked to complete the survey online. The questions which had to be answered comprised of open ended questions. They were not related to the conceptual framework in any way.

4.3.1 ANALYSIS PROCESS

The analysis process for the survey took place in six steps.

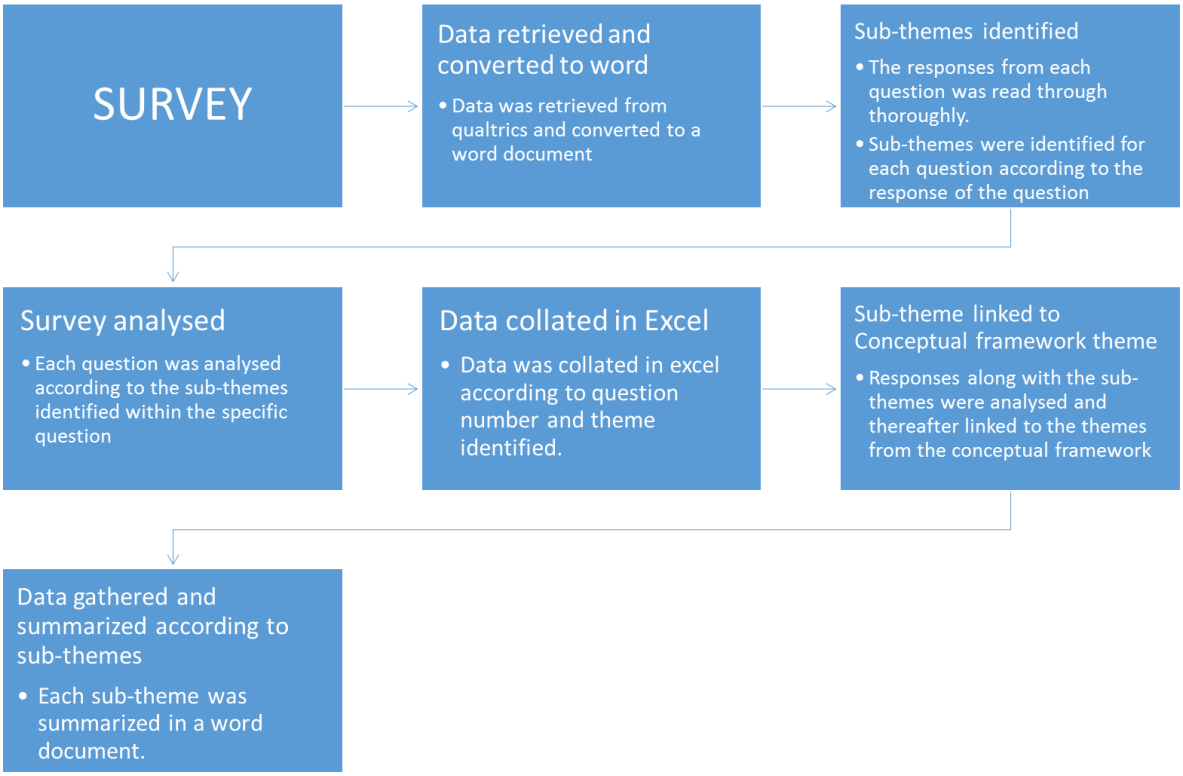


Figure 22: Analysis process for the survey

Figure 22 illustrates the steps which were taken during the analysis process for the survey. The steps will be discussed in more detail below.

4.3.1.1 Step 1: Data retrieved and converted to word

Once the students had answered the surveys, data was retrieved from qualtrics. Qualtrics is a management system which allows one to gather and analyse data. Once the data had been retrieved from qualtrics, it was converted into a Microsoft word document.

4.3.1.2 Step 2: Sub-themes identified

Once the data had been converted to a word document, I read through the responses of the students, question by question. Within each question, subthemes were identified through the reiteration of statements within the survey responses.

4.3.1.3 Step 3: Survey analysed

The subthemes were colour coded. **Note, the colour coding of the sub-themes do not relate to the colour coding of the conceptual framework in any way**. Each question of the survey comprised of its own set of sub-themes.

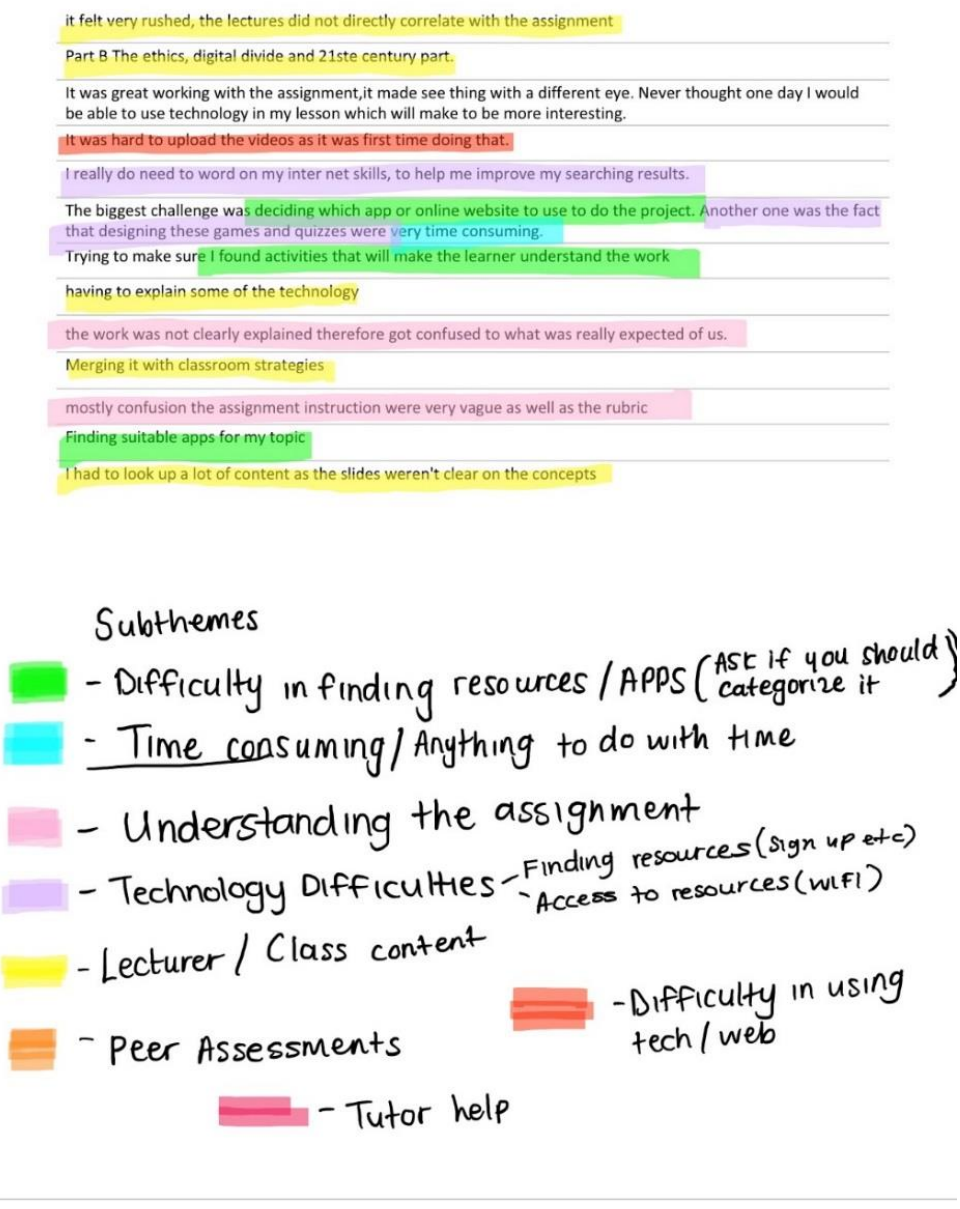


Figure 23: Example of sub-themes identified as per question in the survey

Figure 23 shows the sub-themes which were identified for this particular question along with the colour for each sub-theme.

Once the subthemes were identified within each question, the responses of the survey were analysed according to these subthemes.

Each statement was critically analysed and colour coded.

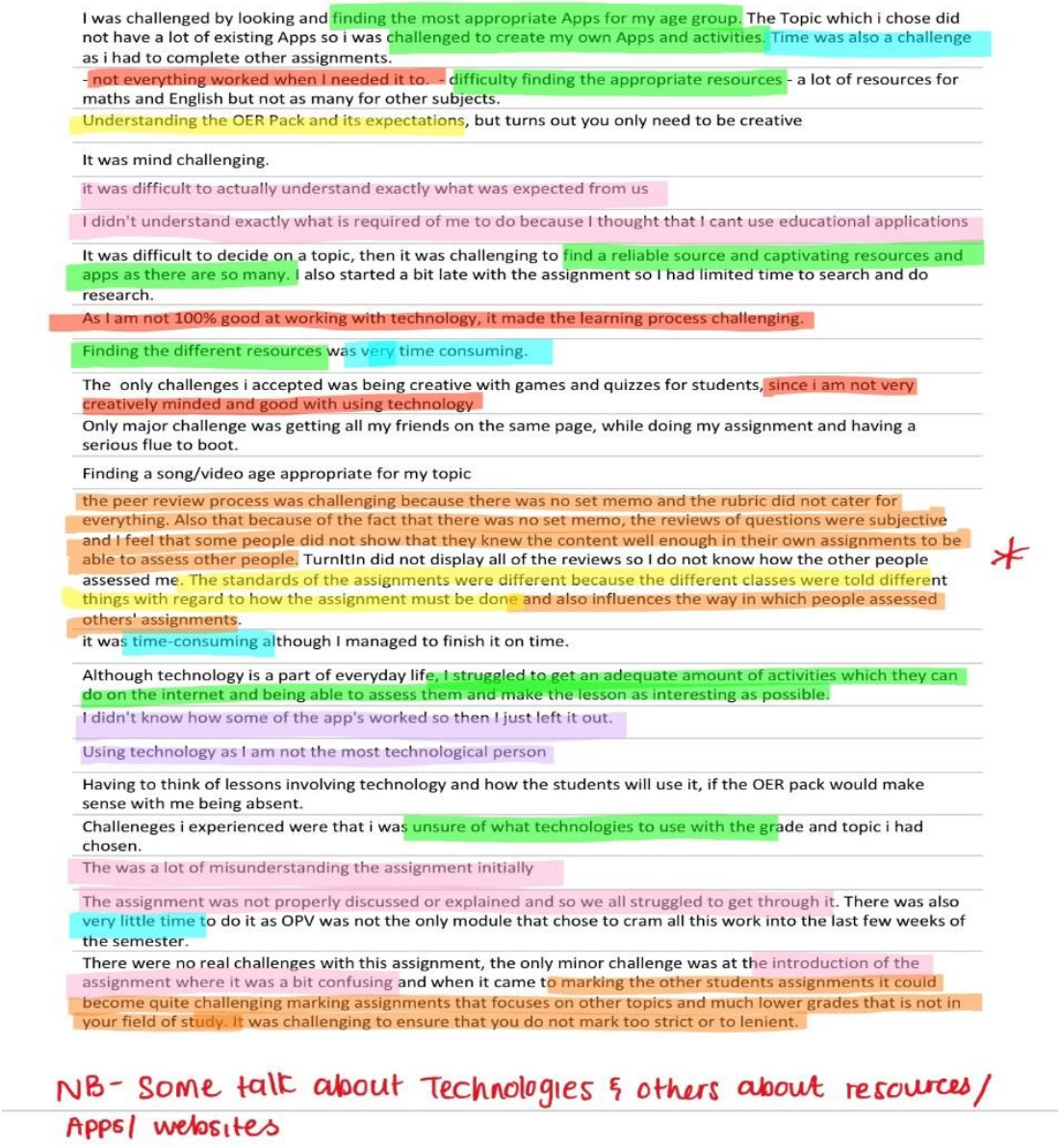


Figure 24: Example of the survey analysed according to sub-themes

Figure 24 shows the survey along with the critical analysis. Each statement was analysed and highlighted according to the sub-theme under which it was identified.

4.3.1.4 Step 4: Data collated in Excel

Once the analysis process was completed, the data was collated in an excel spreadsheet.

The data was collated according to the question and subtheme identified. Each excel spreadsheet comprised of a different subtheme which had been identified. Statements were then placed in these subthemes.

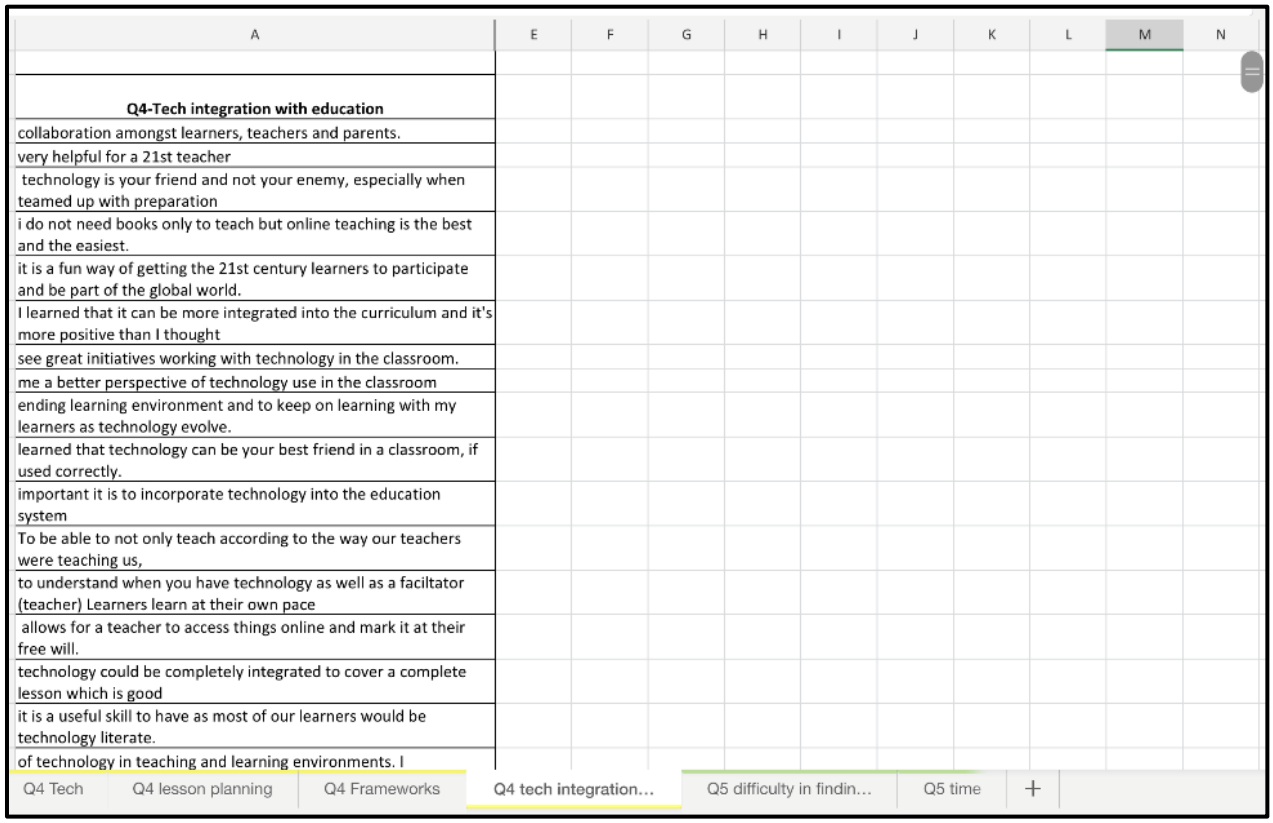


Figure 25: Excel spreadsheet along with sub-themes identified

Figure 25 shows the excel spreadsheet along with the various themes for each question. Statements for each theme were placed under the sub-theme in which it was identified.

4.3.1.5 Step 5: Sub-theme linked to the conceptual framework theme

The data collected within each subtheme was read through thoroughly. Thereafter a link was made to the various themes in the conceptual framework.

Each statement was than plotted in the conceptual framework themes which were identified within each question.

Q4-Tech integration with education	Reflection	Authentic experience	Role model
collaboration amongst learners, teachers and parents.	●	●	
very helpful for a 21st teacher		●	●
technology is your friend and not your enemy, especially when teamed up with preparation	●	●	●
i do not need books only to teach but online teaching is the best and the easiest.			●
it is a fun way of getting the 21st century learners to participate and be part of the global world.		●	
I learned that it can be more integrated into the curriculum and it's more positive than I thought	●		●
see great initiatives working with technology in the classroom.		●	
me a better perspective of technology use in the classroom	●	●	
ending learning environment and to keep on learning with my learners as technology evolve.	●	●	
learned that technology can be your best friend in a classroom, if used correctly.	●	●	
important it is to incorporate technology into the education system	●		
To be able to not only teach according to the way our teachers were teaching us,			●
to understand when you have technology as well as a faciltator (teacher) Learners learn at their own pace		●	
allows for a teacher to access things online and mark it at their free will.		●	●
technology could be completely integrated to cover a complete lesson which is good		●	●
it is a useful skill to have as most of our learners would be technology literate.	●		
of technology in teaching and learning environments. I			

Q4 Tech | Q4 lesson planning | Q4 Frameworks | Q4 tech integration… | Q5 difficulty in findin… | Q5 time | +

Figure 26: Example of the spreadsheet along with the themes identified

Figure 26 shows the excel spreadsheet along with the sub-themes under which each statement was plotted. After analysis of the statements within each sub-theme, links were made to the themes within the conceptual framework. As illustrated above, each statement was linked to a theme in the conceptual framework.

4.3.1.6 Step 6: Data gathered and summarised according to sub-themes.

One the analysis has been completed according to the themes in the conceptual framework, all data was gathered and summarised in a document according to the themes in the conceptual framework. This step is illustrated in Chapter 3.

4.3.2 THE QUESTIONS IN THE SURVEY ANSWERED BY STUDENTS

The survey consisted of seven open ended questions which students had to answer. However, for this study, only three questions were used for data collection. These questions were:

Question 4: Describe the positive experiences and lessons learnt during theme 3 about the use of technology in education.

Question 5: Share the challenges you experienced during your work in the assignment for theme 3.

Question 6: What did you learn through and about assessment/online assessment during the peer assessment process?

The response of these questions will be discussed below according to the sub-theme under which it was identified.

4.3.2.1 Question 4

Describe the positive experiences and lessons learnt during theme 3 about the use of technology in education.

Within the question, various sub-themes emerged. These were:

- Positive about technology use
- Negative about technology use
- Teaching techniques
- Technology (apps/websites)
- Lesson planning
- Frameworks
- Technology integration

The response of the question will be answered under the relative subtheme identified.

a. Positive about technology use

In the survey, students expressed how they felt regarding the incorporation of technology in their lessons. Many students responded in the affirmative and thought

technology integration had its benefits, not only for the learners but for the educators as well.

Students mentioned that the use of technology in a classroom certainly does “enhance a learning” and makes the learning experience more exciting. It makes the lesson “fun”, “interesting” and “it enhances a lesson”. With the variety of resources, apps and websites available, one can easily incorporate technology in a lesson. Apart from technology allowing for “greater understanding of content”, students felt that it creates a more interactive environment and more engagement between the educator and learners. A student mentioned that technology integration allows educators to “grab their attention but still educate them” and “technology is a tool which can advance learning”. Additionally, it is mentioned that “there are many ways in which we can use technology in teaching for effective teaching and learning”

Students were taught how to incorporate technology in a lesson through demonstration and exposure to various resources. Students in the survey refer to “resources” in the context of websites, apps and other online resources. Students were taught how to make a classroom interesting by incorporating teaching strategies and technology integration “through the use of e and m-learning”. A student mentioned that it could be exciting using technology as “a source of instruction”. Additionally, students mentioned, regarding technology incorporation, that; “I learnt about the importance of making learning fun while keeping to the curriculum” and “I learnt how to use advanced technology to facilitate learning and make learning fun and interesting for the learners.”

b. Negative about technology use

There were a handful of students who had their doubts regarding technology integration. These were not centred on the content taught in class or the teaching strategies used. Rather, the views expressed were from a high-level point of view.
Students felt that as South Africa is still a developing country, technology integration might be a challenge. This is due to the shortage of computers at schools. Additionally, a student mentioned that the country is not “equipped to have technology as a major method of teaching now”. Additionally, it was mentioned that there is a major gap in terms of e-learning between South Africa and other countries.

Another concern raised was the reliability of technology integration. Students felt that there “nothing to fall back on” if a technological difficulty is experienced.

c. Teaching techniques

In the teaching of the module, students were taught either through demonstration or theory about different teaching techniques which can be used in a classroom with the aid of technology.

Students mentioned they learnt other techniques which they can use to present a lesson. Alongside that, they learnt how to integrate technology in a lesson while adopting these teaching strategies. It was mentioned by a student that they learnt how to be “flexible” when integrating technology in a lesson. Additionally, they also learnt “how to incorporate more than one e-resource” in a lesson while focussing on content which needed to be covered for the lesson. Furthermore, they were also taught how to find and create resources which would suit their lesson. A student mentioned, “I have learnt to integrate many different forms of technological activities in my lesson”.

d. Technology (apps/websites)

Apart from technology hardware, integration in a lesson requires incorporation of e-resources. E-resources come in the form of apps, videos, images, websites, simulations and online worksheets, among others. In the module, students were taught how to find and create these resources.

Students were also taught how to find and create e-resources. There is an abundance of resources to make use of available. Students discovered that there were “new ways of assessing” students and some apps or resources are rather “helpful” and “insightful”. A student mentioned, “I learnt that there are much more applications that are useful than I knew of”. It allowed students to “explore” what is out there for them to use. It is mentioned “I have learnt that every application or game or video has a form of lesson in one way or another”. However, students mentioned that although there was an abundance of resources available for use, it was rather “time consuming” to find the right resource.

e. Lesson/ Lesson planning/ OER

The module aims to teach students how to integrate technology in a lesson. However, for successful technology integration to take place, one needs to plan orderly.

Students learnt how to plan and create a lesson incorporating technology. They learnt how "useful" and "easy" it is to design a lesson incorporating technology. Alongside the planning, students realised how much there were effort and "planning that goes into planning an interesting and interactive lesson".

Students were exposed to various resources during class. Students did not realise the abundance of resources which were available for them to use. However, when incorporating any technological resources, one needs to know how to "use the internet effectively". This was taught to students in class.

f. Frameworks

The theoretical part of the module teaches students about various frameworks which they can adopt during their planning or teaching in a classroom. Students made mention of these concepts vaguely when answering the survey.

While some concepts were taught to students, others were demonstrated to them. Examples of concepts taught include the "backward design", "TPCK model" and "Gamification". Students also learnt "how important it is to use e and m-learning". A student mentioned that she learnt the "combining of theory and technology".

g. Technology integration with education

Along with the benefits technology integration has for learners, it reaps benefits for teachers as well. If planned well and utilised correctly, it can make the teaching experience easier and more enjoyable.

Students were taught how to plan for integrating technology into a lesson. Students mentioned if teachers were well prepared, technology integration could be "successful". Additionally, it can make teaching "easier" and "simpler". Alongside the planning for technology integration comes learning new skills regarding this

integration. Students feel it is vital to learn these skills as “technology is rapidly growing”.

With technology integration, one needs to be open and flexible to new ideas. Students realised that “the boundaries of teaching in a classroom should be shifted” if one is implementing technology in a lesson. A student mentioned, “As future teachers, we should learn how to incorporate technology into the learning process because technology is part of their lives”, while another student mentioned “technology actually makes a teachers job so much easier and the students end up learning mire without even realizing it!”.

4.3.2.2 Question 5:

Share the challenges you experienced during your work in the assignment for theme 3

Within the question, various subthemes emerged. These were:

- Time
- Understanding the assignment
- Difficulty in finding resources
- Technology difficulties
- Peer assessment
- Lecturer or class content
- Difficulty in using technology or the web
- Tutor help

This question will be answered according to the subthemes identified within this question.

a. Time

Students reflected on how long it took them to find resources and complete the assignment. Students mentioned if they had more time, they would have done a better job. Additionally, students realised that they misinterpreted how time consuming it was to plan a lesson.

b. Understanding the assignment

Every individual understands and perceives things differently. When assigned a task, everyone completes it to the best of their understanding. Students were given an assignment of designing on Open Educational Resource. The assignment was explained to students in class, however, some students misunderstood the instructions.

Students mentioned that the instructions of the assignment were unclear. Students mentioned the instructions were “difficult to understand”, “confused with what exactly I was supposed to do” and found the requirements to be “very vague”. Students did not know what was expected of them and did not know where to start with the assignment. The instructions differed greatly hence, each student completed it to the best of their understanding.

c. Difficulty in finding resources

As part of the assignment, student’s had to find or create e-resources to incorporate in their assignment. During class, students were taught how to find and create resources. Students were also taught how to find a resource given specific criteria. While finding resources might be time consuming, some students found difficulty in finding or creating these resources.

Students mentioned they struggled to find and create resources. Regarding apps, students mentioned that they struggled to find apps which were “appropriate”, “fit the topic”, “age-appropriate” and “credible” among others. While some students struggled to find resources, others were unsure of what to use. A student mentioned, “I was unsure of what technologies to use with the grade and topic I had chosen”. Another challenge which students faced, was making a resource available to use. As mentioned by a student “it is not always easy to find the app you’d like to use, and it’s not always easy to create one. Sometimes the ideas you have are difficult to put on paper”.

d. Technological difficulties

Technology is not something which can be learnt overnight. It is a process and develops as technology advances. All students have different levels of

competencies regarding the use of technology. While some students are highly technologically literate, others only know the basics.

Some students' challenges during the assignment had to do with technological difficulties. Students struggled with "adding links", "apps would not open" and "taking screenshots" among others. Some students did not have constant access to Wi-Fi, hence access to finding or creating resources was a problem. Furthermore, some students did not have devices equipped to download the content necessary for class or the assignment. A handful of students also struggled with creating resources such as QR codes. While some students struggled with technological difficulties, a student had a different challenge overall; he/she mentions "overcoming my irrational fear of embracing technology".

e. Peer assessment

Part of being an educator requires one to assess learners. Students were given the opportunity to assess their peers' assignments using an online system. This was the first time that students were exposed to an online marking system. Students had to mark on a rubric. No memo was provided to students as this was an open-ended assignment. While some students thoroughly enjoyed the experience; some students found it difficult.

Students felt the marking varied greatly from person to person as people had different viewpoints. Some found this process to be "challenging" and "unfair" as they felt the "rubric did not cater for everything". Alongside that, students had to mark assignments of subjects and grades with which they were not familiar. Regarding the technological aspects of marking, some students found that they could not always access hyperlinks.

f. Lecturer/class content

There were three lecturers allocated to teach the module. Apart from only lecturing the content, lecturers had to make sure they were well prepared to teach what was required. As mentioned previously, students were taught through demonstration in some cases.

While some students felt that the demonstrations helped greatly, others felt that in some cases an additional explanation was needed. Students struggled with “contextualising concepts”, “grasp TPCK” and “implementing e-learning into lessons”.

Students mentioned that “different lecturers wanted different things”. Additionally, students felt that they needed more clarity regarding what was expected of them. A student mentioned,, “it felt very rushed, the lectures did not correlate to the assignment”.

g. Difficulty in using technology/web

As mentioned previously, all students do not have the same competencies when it came to using technology. This sub-themes specifically deals with the difficulty which students faced when using technology which they saw as a challenge, as indicated in their responses to the question asked.

A minority of students felt rather overwhelmed with all the technology integration. However, they took time out and learnt how to use the basics and completed the assignment. While some felt intimidated with the use of technology as a whole, others felt it was only a difficult task to accomplish because it had to be integrated into a lesson.

Students mentioned they had difficulties with certain technical aspects of the assignment. Among these difficulties were “uploading videos”, “creating QR codes” and “everything didn’t work when needed”. Additionally, some students struggled to find apps or resources related to the subject choice or topic. Students showed concern regarding “inappropriate pop-up videos” and advertisements from certain resources which they chose to use.

h. Tutor help

Students had access to a tutor after class. The tutor was available for all students during a certain part of the day. The tutor was appointed to assist students with any uncertainties regarding the assignment or any content which students might not understand.

Students mentioned they approached the tutor with regards to understanding the assignment. Once they consulted with the tutor “uncertainties were clarified”, and they found the assignment “light and enjoyable”.

4.3.2.3 Question 6:

What did you learn through and about assessment/online assessment during the peer assessment process?

Within the question, various subthemes emerged. These are:

- Easy/effective
- Creative thinking
- Understanding the assignment
- Fairness of marking
- Different ways of thinking
- Different levels of effort
- Learnt how to mark

The question will be answered according to the subthemes identified.

a. Easy/effective

Students were anonymously assigned four assignments which they had to mark and on which they had to comment. All parties remained anonymous during this process, i.e. the person who submitted the assignment as well as the assessor.

Because this process was anonymous, students found it “easier to mark”. Additionally, students found the overall marking process to be “fast”, “easy”, “effective”, “convenient” and “simple”.

b. Creative thinking

The peer assessment process allowed students to get exposure to other students ideas as well as resources which they did not come across. They can incorporate these ideas and resources in their teaching one day. It allowed students to see how diverse students are when it comes to ideas which they contribute.

Students noticed the creativity of their peers through the assignments which they had to assess. It was mentioned that while some of their peers' work was “boring”, others were “creative”, “innovative” and “interesting” and “everyone has their own way of making the lesson more interactive”. Furthermore, it was said that students did not only want to do well, they wanted to “incorporate an understanding beyond the content of the topic”.

c. Understanding the assignment

When given a task, everyone completes it to their understanding. This was the case with regards to the assignment which the students were given.

Students mention regarding the assignment that “instructions were understood differently by every learner”. Students felt they had no clarity regarding wat was required of them to do. It is mentioned “all student’s had different ideas about what the project actually entailed” and “some did not understand the point of the assignment”. However, a student mentioned, “I could tell whether students have understood what was expected of them or not”.

d. Fairness of marking

To see if progress is being made, assessment needs to take place. However, the grading of this assessment needs to be fair and unbiased. Depending on the type of assessment or questions asked, sometimes one needs to be open-minded when assessing. The assessment which students had to conduct was done using a rubric. No memo was provided as it was an open-ended assignment.

Students experienced what it was like to mark using an online system. While some students found it to be quick and easy, others had different views. Students mentioned “it’s not as easy as it seems” and “you need patience”. It was mentioned

that everyone did not assess fairly, and some students “just clicked random numbers”, and some marked without reading the contents of the assignment. Students felt their “peers are more critical, with regards to marking and commenting”.

On the other hand, students felt this experience helped them to “develop my marking skills”. Additionally, the students experienced what it was like to assess on an online system. As mentioned by a student, “I learnt to be fair when it comes to marking the assignment as the rubric was provided”. Students felt online marking was quicker than paper-based marking.

e. Different ways of thinking

As mentioned previously, every individual perceives things according to their own understanding. With regards to the assignment, every student completed it according to their understanding. As part of the assignment, students had to assess their peers’ assignments. This exposed them to other students’ assignments and ideas.

Students mentioned the diversity of assignments to which they were exposed. They mentioned that all students had their own interpretation and understanding of the assignment. Furthermore, they realised how “we all think differently” and “how a lot of people think like you do just how they express it differently”. Additionally, students realised how one needed to be “open-minded” as “everyone has different ideas, and one should be flexible and willing to learn from others even if their ideas differ from yours”. Students were exposed to resources which they could use in their lessons one day, as mentioned by a respondent “it gave me more ideas of apps to use”.

With regards to marking, the students felt that on some occasions, their peers did not understand what they were trying to portray in their assignment. This was because students “mark the assignment based on their understanding”. Students felt their peers should “be more open-minded when assessing other people”.

f. Different levels of effort

Each individual completes something to the best of his or her ability. In some cases, some might put in their all, however, it may not be sufficient for someone else.

The students noted that the assignment took time and one needed “patience” to find or create the resources needed. While some students took the time and effort to complete the assignment to the best of their ability, others “didn’t bother” or “do not take their work serious”. A student mentioned, “I could tell who gave it their all and who started two days just before the due date”. Furthermore, students criticised the professionalism of the assignment which their peers submitted. While some students wrote and presented “professionally” other students “can’t spell, incorrect use of grammar and punctuation”. Students found this worrying as they were third-year students.

With regards to marking, the students felt that they were “taking responsibility of someone’s work”. Students said that they had to practise caution when marking, and in some cases, they would “read everything twice” to ensure they correctly understood what was being portrayed. Additionally, a student mentioned, “I have learnt that a lot goes into marking and that grammar, spelling and how something is presented can play a big role when marking”.

g. Learnt how to mark

A part of being an educator means one needs to assess learners. The students were given the opportunity to mark on an online system. This was the first time many students got to experience marking online.

The students mentioned they learnt how to mark online or “use assessment on my computer”. They found this to be a “quick method to assess”. For a handful of students, this process taught students how to “assess other peoples’ work”. As mentioned by a student “I learned that assessment is all about reviewing a learner’s progress”.

4.3.3 SURVEY RESULTS

The results are discussed below according to the themes in the conceptual framework. This is step six in the analysis process, as discussed in Section 4.3.1.6.

4.3.3.1 Instructional design

As mentioned previously, instructional design refers to the various teaching strategies and theories which are implemented by the lecturer to teach the class.

With regards to the teaching techniques used in the class, students mentioned that they learnt other ways or techniques to present a lesson. Additionally, they have also learnt there are many ways in which technology can be integrated into a lesson, and one needs to be flexible when making use of the integration of technology in a classroom.

The students were given an assignment to complete, which required them to plan a lesson integrating technological resources. Students could find or create these resources. A common issue or challenge was understanding what was required of the assignment. While some respondents felt they “did not know what was expected of them”, others felt that the instructions as well as the rubric were vague.

4.3.3.2 Role model

A role model is someone looked up to with the intention of adopting their ways. Lecturers acted as role models for students regarding how they (the students) should teach in their classrooms through integrating technology.

Through demonstration, students learnt how to use other teaching techniques in the classroom. They witnessed how technology integration made teaching easier. Moreover, it “makes everything compact; it simplifies work more for the teachers than the learners”. Additionally, students said they learnt how technology could be integrated into an entire lesson and within the curriculum. However, this will only work well if “one is well prepared”.

Part of the module consisted of teaching students how to search for relevant e-resources. Students learnt how to find and in some cases, create e-resources. They also learnt how to plan a lesson incorporating these e-resources. Students mentioned that technology integration leads to “greater engagement and interaction with students”.

4.3.3.3 Collaboration

Collaboration is when different parties work together to achieve something. In this scenario, it was the students, lecturers and in some cases, the tutors who collaborated to assist one another where needed.

In the module, students had the option of consulting the tutor for assistance regarding the content or the assignment. Students collaborated with the tutor by asking for assistance regarding the uncertainties of the assignment.

4.3.3.4 Feedback

Feedback assists students in terms of providing insight regarding where they could improvise or make necessary changes. However, in this case, the feedback was given regarding how students felt about integrating technology in their teaching.

The respondents expressed many views, some of which could be used as a form of feedback for the lecturers. Among these views, a variety of opinions were expressed regarding the outlook on technology use, understanding of the assignment, the lecturer and content covered in class as well as views on the assignment as a whole.

Respondents of the survey mentioned that they learnt how to integrate and incorporate technology into their lessons while teaching and assisting with learning. They noticed how the incorporation of technology in a classroom makes the learning process “interesting”, “fun” and “effective”. A respondent mentioned that “I learnt about the importance of making learning fun while keeping to the curriculum”.

With regards to teaching, students learnt how to incorporate various teaching strategies with the aid of technology. In this context, technology includes technological devices as well as e-resources. Respondents were positive about the

use of incorporating technology as a source of instruction in their classrooms and mentioned, “I learnt how to make the classroom more interesting through the use of e and m-learning” and “lessons can be exciting with the use of technology as a source of instruction”.

However, some students felt differently about the incorporation of technology in a lesson. With South Africa being a developing country, all e-resources are not available to us as are to other countries due to the major gap in terms of technology. Additionally, students mentioned that in some cases, technology was unreliable and “there is nothing to fall back on if something goes wrong”. Time management was also considered an issue by some students.
In terms of the class itself, time was fairly limited as this module was presented over six weeks. Lecturers, in some cases, taught through demonstration. Classroom strategies were demonstrated to students alongside the use of technology. However, some students felt that demonstrations were not always enough, and more explanation was needed regarding certain topics. Furthermore, some students felt that incorporating technology in a class has its limitations.

Students were asked to complete an assignment on designing a lesson incorporating e-resources in a lesson. Students felt that instructions were unclear, and they “did not understand when the assignment was being discussed in class”. A view which surfaced many times was how each student interpreted the assignment differently. This was because students did not have clarity on what was required of them. A challenge which some students faced was trying to understand how others interpreted the assignment before assessing it. A handful of students mentioned that once they consulted the tutor, they gained more clarity regarding what was required of them in the assignment.

A challenge which students experienced was using technology to find or create resources or incorporate technology in a lesson. A student mentioned that “it was a challenge, but I managed to learn and complete the assignment”. Students received assistance from their peers or the tutor.

Each individual is unique in their way of portraying something. Students took note of this when they were assessing the assignments presented to them. They noticed that each student “perceives things differently” and completed something according to their understanding. While some students presented creativity with their incorporation of technology within a lesson, others were rather “boring”. As mentioned by a student, “it was interesting to see how other people approached the assignment…”

Coupled with the uniqueness of every assignment, students took note of the effort which their peers put into the assignment. A student mentioned that “some of the learners put effort in and some just do it to get it over with”. This shows which students are dedicated to their work.

With the peer assessment process, students were not only exposed to marking using an online system. They were exposed to their peers' work and the resources which their peers made use of in their assignments. Students did not know about the vast number of resources which were available for them to use online. Additionally, they were exposed to the creativity of others and could gain ideas for their teaching.

The peer assessment process differed between individuals. While some found it “easy”, “effective”, “simple”, “fast” and “convenient”, others found it to be “unfair” and “challenging”. Each individual perceives and understands things in his or her way and sometimes might misinterpret something. Some assignments were not “professionally written”, and others would not open up the hyperlinks. Some students felt that the peer assessment process was unfair as some assessors did not comment on why they graded the way they did. On a positive note, a student mentioned that with the exposure of peer assessment, one was exposed to “seeing what the various resources which can be used is out there, and how everyone uses their own creativity to teach something or get a message across”

Students learnt how to find and create resources using the internet. They realised the immense number of resources available for teachers to use, which are “helpful”, “free, and “fun”. However, it is challenging and time consuming finding suitable apps and resources to utilise in one’s lesson. The exposure to all of these resources

opened up the minds of students by showing them that there are new and exciting ways to assess in a classroom.

4.3.3.5 Authentic experience

Authentic experience comes from learning through example or demonstrations.

In some cases, students were taught through demonstration. They were taught how to incorporate technology in a lesson while using various teaching techniques. Demonstration was beneficial as students witnessed how technology and different e-resources could be integrated into a lesson while teaching. Students mentioned that they noticed one had to be “flexible” and have the ability to “shift boundaries” when integrating technology. It is important to learn these new skills as the use of technology within an educational context is increasing rapidly. While some students felt that the demonstrations helped greatly in understanding how technology could be integrated, others felt that it was rather “rushed”. A respondent mentioned, “participation in a lesson helps when trying to understand a concept”.

There are many e-resources which are available on the internet for teachers to use. These certainly assist in making the classroom a “fun” and “interactive” environment and “improves the classroom experience”. As mentioned by a respondent “I learnt how to use advanced technology to facilitate learning and make learning fun and interesting for the learners”.

While many benefits can be reaped from integrating technology in a lesson, one needs to keep in mind that successful integration can only occur if one is well prepared. If one is prepared, it certainly makes “the teaching and learning process easier” and “much more enjoyable”. As part of the module, students learnt how to plan for a lesson integrating technology. Students mentioned that they did not know how easy it was to incorporate technology in a lesson. Along with that, one needs to keep in mind that there is a lot of effort and planning that goes into a lesson incorporating technology. Students were taught how to use the internet safely, along with how to find and create resources for one’s lesson.

Students were given the opportunity to experience how to mark on an online system. Students mentioned that they learnt how to assess using a computer and found the process to be “fast”. Additionally, it allowed them to learn how to assess using a rubric, and it “developed marking skills”. However, due to the nature of the assignment, no memorandum was provided. Some students found this to be a problem along with the rubric which “did not cover everything”. Students felt that there was a great variation in the objectivity of marking and “it is not as easy as it looks”.

4.3.3.6 Reflection

Reflection allows one to review the effectiveness of one's skills and embrace change if necessary. Students, in this case, reflected upon the integration of technology in their teaching.

A common view among respondents of the survey was that the use of technology in a classroom certainly augments a lesson. As mentioned by respondents, technology integration makes the lesson “fun”, “interesting”, “effective” and “it enhances the lesson”. There is a variety of e-resources which can be used to enhance a lesson. These include videos, apps, online games and images, among others. This does not only make the learning process more exciting, but it also makes teaching easier. It allows for a greater understanding of content and a more interactive classroom environment. Technology integration educates students while keeping their attention during class. A respondent compared how the integration of technology could enhance a lesson and said: “It really opened my eyes to how much technology has enhanced teaching experiences since I was in school which wasn’t even that long ago”. As one respondent put it, “technology is the best tool that one can use to teach”.

As mentioned previously, technology carries great benefits when it comes to enhancing a lesson, and it certainly revolutionises the teaching and learning process. It can be used successfully if teachers plan accordingly. It can make the teaching process much “easier” and “simpler”. In the module, students were taught how to plan for a lesson incorporating technology. It was mentioned that “I got to

see the amount of planning that goes into planning an interesting and interactive lesson". Students mentioned that they did not realise how time consuming it was to plan a lesson incorporating technology. Additionally, they felt that it is important and vital to learn these skills as incorporating technology into teaching is a rapidly growing trend. For the learners, apart from allowing them to learn about technology, it creates excitement.

While some students were comfortable with using technology, others battled. Some felt overwhelmed and took time to grasp how to use and integrate technology. Among the challenges which students faced regarding finding and creating resources, students mentioned that they struggled to "find relevant apps" which were credible, free and age-appropriate. Additionally, there was disquiet regarding online pop-up advertisements which were deemed inappropriate for younger learners.

There was a sense of misperception when students mentioned the assignment. While some students knew what to do, others did not "understand the instructions". Students took note of the diverse thinking patterns and understanding of the assignment. A concern which was raised was being assessed by someone who does not understand the assignment the way you did, as different people understand and perceive things differently. On a more positive note, students mentioned that they got to see their peers' work and their ideas

Students had the opportunity to mark their peers' assessments online, anonymously. It was mentioned that students not knowing whose work they were marking, made the process easier. Overall, respondents felt that online marking was a quick and convenient way to assess. Marking requires one to have patience, honesty, and it is something which needs to be carefully done. However, some felt that some assessors marked without reading. It was also stated that peers seemed to be "more critical when it comes to marking and commenting".

Students took note of the creativity and diversity in terms of thinking processes when they were assessing their peers' assignments. Students mentioned that each assignment was "different", "creative", "innovative" and "interesting" and each

student had their own ideas, each expressed differently. Students don't only want to do well; they want to "incorporate an understanding beyond the content of their topic". With the scope of technology being so vast, the number of resources which are available out there is phenomenal, so each student might have discovered something different which explains the diversity in the assessments.

4.3.3.7 Access to resources

Access to resources refers to all hardware and software material which students had to access during the duration of the module. It is important to keep in mind that "resources", in this case, mean technological resources as well as e-resources.

Students mentioned that due to the shortage of computers in schools, technology use might be a challenge. A student made mention of the country not being "equipped to have technology as a major teaching method now". They feel that this country is still a developing country and technology integration in some cases will just not be possible due to the lack of technology available. Additionally, a handful of students mentioned that technology could be unreliable at times. This is because there isn't always something to fall back on if a problem arises.

Students found difficulty in finding and creating resources. With regards to finding resources, students mentioned that finding the right resources which were applicable to the subject content and which were age-appropriate were difficult to find and very limited in some cases. Another issue which students faced was finding applicable apps which were free and compatible with all devices. When creating resources, uploading content or accessing the resource after it had been created was deemed problematic. Students mentioned that not all resources worked when needed.

4.3.3.8 Training staff

The various parties who plan, lecture and tutor the module have to be kept up to date regarding educational technology.

Students were fortunate enough to have access to a tutor for the module. A handful of students mentioned they made use of the tutor's services. As mentioned "the tutor assisted me where I did not understand".

4.3.3.9 Preparing pre-service teachers for technology use

This refers to the content of the module, the outcomes which students need to achieve as well as the skills and knowledge needed in order to succeed in this module.

During the teaching of the module, students were exposed to various technologies and teaching strategies. Furthermore, they learnt how to integrate technology using these teaching strategies with technology as a teaching tool. Additionally, they learnt how to find, create and incorporate multiple e-resources in a lesson. With the combination of theory and technology, students learnt a lot through demonstration. Apart from seeing how technology can be incorporated in a lesson, students also learnt how to plan for a lesson integrating technology. A student mentioned he/she learnt "how easily technology can be incorporated in a classroom".

4.4 Synthesis of focus group interview and survey

The data collected for this study comprised of a focus group interview and surveys which were answered by students who completed the module. Once the data was analysed for each instrument, the data was collated and summarised accordingly.

4.4.1 ANALYSIS PROCESS

Once the data was analysed for each instrument, the data was collated and summarised accordingly. The summarised data was then further analysed. The analysis process of the combined data took place in four steps.

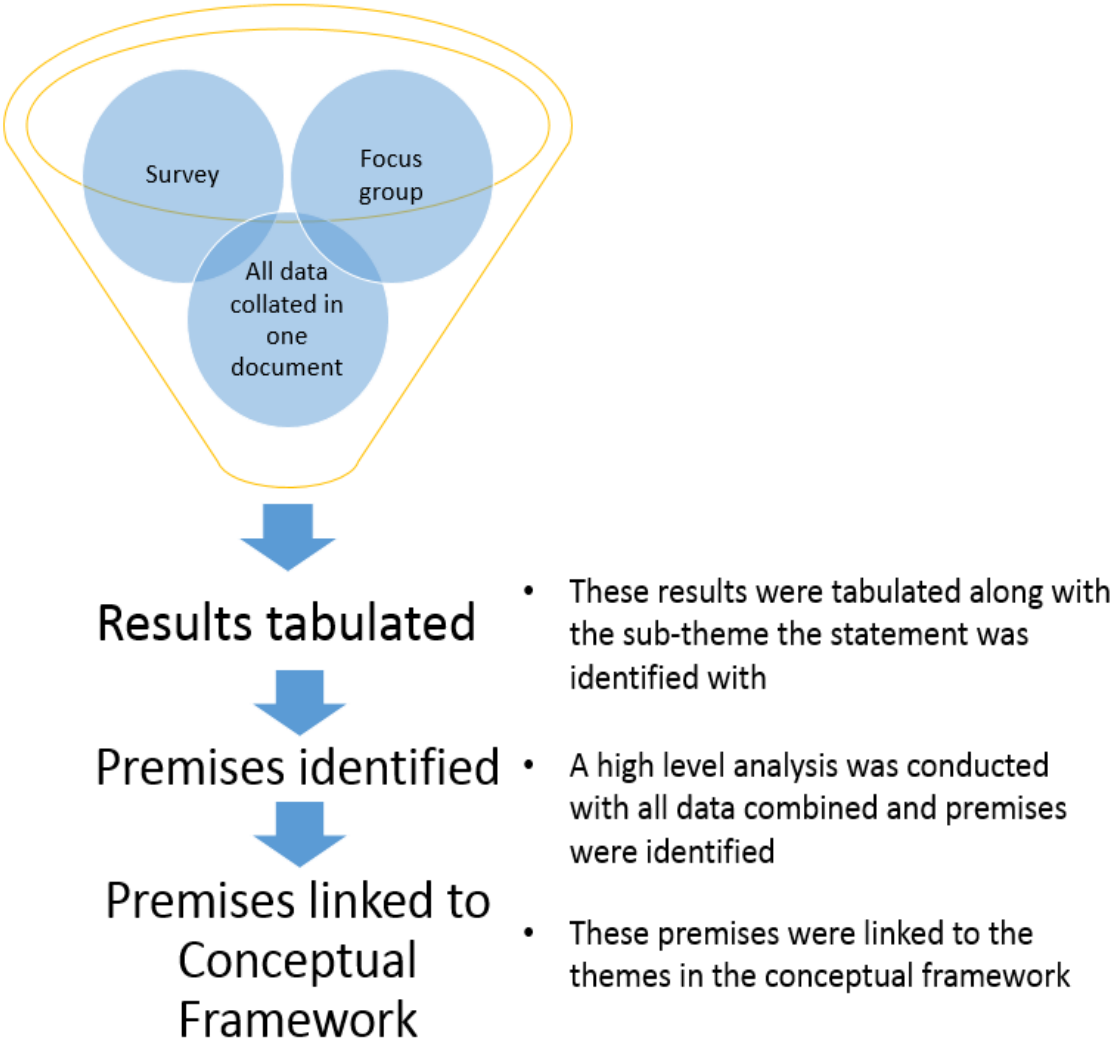


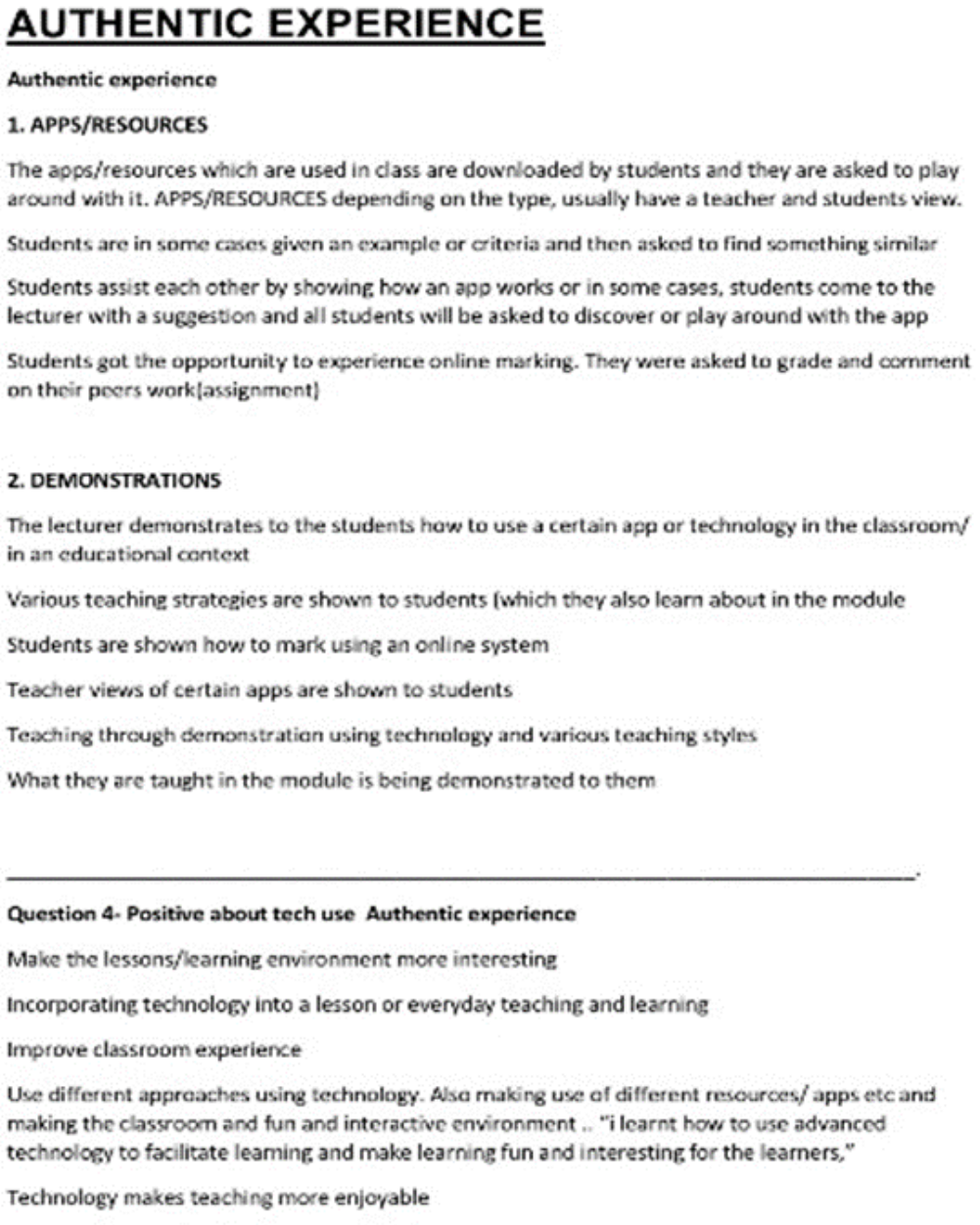
Figure 27: Analysis process of the synthesis of data

Figure 27 illustrates the steps taken during the analysis process of the combined data. These steps will be further discussed below.

4.4.1.1 Step 1: All summarised data combined in one document

The data collected for this study comprised of a focus group interview and surveys which were answered by students who completed the module.

Once the data was analysed for each instrument, the data was collated according to the themes in the conceptual framework and summarised in a word document from a lecturer's and student's point of view.



AUTHENTIC EXPERIENCE

Authentic experience

1. APPS/RESOURCES

The apps/resources which are used in class are downloaded by students and they are asked to play around with it. APPS/RESOURCES depending on the type, usually have a teacher and students view.

Students are in some cases given an example or criteria and then asked to find something similar

Students assist each other by showing how an app works or in some cases, students come to the lecturer with a suggestion and all students will be asked to discover or play around with the app

Students got the opportunity to experience online marking. They were asked to grade and comment on their peers work(assignment)

2. DEMONSTRATIONS

The lecturer demonstrates to the students how to use a certain app or technology in the classroom/ in an educational context

Various teaching strategies are shown to students (which they also learn about in the module

Students are shown how to mark using an online system

Teacher views of certain apps are shown to students

Teaching through demonstration using technology and various teaching styles

What they are taught in the module is being demonstrated to them

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Question 4- Positive about tech use Authentic experience

Make the lessons/learning environment more interesting

Incorporating technology into a lesson or everyday teaching and learning

Improve classroom experience

Use different approaches using technology. Also making use of different resources/ apps etc and making the classroom and fun and interactive environment .. "i learnt how to use advanced technology to facilitate learning and make learning fun and interesting for the learners,"

Technology makes teaching more enjoyable

Figure 28: Example of the summaries of all data as per conceptual framework

Figure 28 shows the summary of both the focus group and survey combined as per theme from the conceptual framework.

4.4.1.2 Step 2: Results tabulated

The results from each theme were then placed in a table along with the subthemes identified. Depending on the statement, the subtheme was listed from either the focus group interview or the survey.

Authentic experience

Students were given the opportunity to mark their peers assessments online. They were asked to grade and comment on the assignments they marked. Students said the online marking process was "fast" and "less time consuming". Students also said that the online marking helped them develop their marking skills and they learnt how to mark using a rubric. However, there were more discrepancies regarding the peer assessment process. Students found it "challenging" and "marked with difficulty". Students complained that the marking process was not fair, the rubric did not cover everything and "it is not as easy as it looks"	APPS/Resources	
	Peer assessment	
	Learnt how to mark	
	Fairness of marking	
The classes which students attend contained lots of demonstrations and examples of various teaching strategies as well as APPS/Resources which can be used in a classroom. Where possible, demonstrations were done from an educator and learner point of view so student's got the feel from both ends. Students said they learnt about different APPS and resources as well as 3D technology. They learnt how to create resources and got exposed to many useful APPS	APPS/Resources	
	Demonstrations	
Students learnt about different APPS and how these can be incorporated in a class/lesson. Students seen how "easy", "exciting", "flexible" and "interesting" a class can be if technology is integrated. In some cases, student's felt that the class was being rushed.	Positive about tech use	
	Lecturer/ class content	
	Teaching techniques	
	Tech integration with teaching	
Students got the opportunity to learn and discover the various APPS/Resources available out there for them to use	APPS/Websites	
Students said "participating in a lesson helps when trying to understand a concept" It is important to learn these new skills because of the rate at which technology is growing. If used correctly and one is well prepared, technology can work well. It leads to greater enhancement of a lesson and also interaction with students. There are many resources which are available for teachers to use. It makes the teaching process also easier. One needs to shift boundaries especially when dealing with integration of technology in a lesson.	Technology integration with teaching	

Figure 29: Statements of the summary collated as per theme

Figure 29 shows the statements derived from the summary, along with the sub-themes with which they correspond.

4.4.1.3 Step 3: Premises identified

The statements, along with the subthemes, were carefully analysed. Based on this analysis, premises were identified. Premises were identified from recurring themes or subject matters identified within the summary of the data combined.

Authentic experience

Summary	Sub-theme	Premise
Students were given the opportunity to mark their peers assessments online. They were asked to grade and comment on the assignments they marked. Students said the online marking process was "fast" and "less time consuming". Students also said that the online marking helped them develop their marking skills and they learnt how to mark using a rubric. However, there were more discrepancies regarding the peer assessment process. Students found it "challenging" and "marked with difficulty". Students complained that the marking process was not fair, the rubric did not cover everything and "it is not as easy as it looks"	APPS/Resources	Peer assessment
	Peer assessment	
	Learnt how to mark	
	Fairness of marking	
The classes which students attend contained lots of demonstrations and examples of various teaching strategies as well as APPS/Resources which can be used in a classroom. Where possible, demonstrations were done from an educator and learner point of view so student's got the feel from both ends. Students said they learnt about different APPS and resources as well as 3D technology. They learnt how to create resources and got exposed to many useful APPS	APPS/Resources	Teaching strategy
	Demonstrations	
Students learnt about different APPS and how these can be incorporated in a class/lesson. Students seen how "easy", "exciting", "flexible" and "interesting" a class can be if technology is integrated. In some cases, student's felt that the class was being rushed.	Positive about tech use	
	Lecturer/ class content	
	Teaching techniques	
	Tech integration with teaching	
Students got the opportunity to learn and discover the various APPS/Resources available out	APPS/Websites	

Figure 30: Analysis of data along with premise identified

4.4.1.4 Step 4: Premises linked to the conceptual framework

Once the premises were identified, the content under each premise was analysed. Each premise was then linked to a theme within the conceptual framework.

4.4.2 PREMISE

Based on the results from the combination of all the data, eleven premises were identified. As mentioned in Chapter three, Table 10, a premise is a high-level discussion of various subthemes which were identified in the study. It is a summary of two or more subthemes with a similar topic but discussed in different contexts.

4.4.2.1 Teaching strategy

Teaching strategy refers to the various teaching strategies which the lecturers used in class, taught and demonstrated to the students.

4.4.2.2 Peer assessment

Students were given an assignment. On completion, they had to submit it online. Thereafter, a system randomly allocated four assignments to each student to mark. Students had to mark and comment on their peers' work. This process was done anonymously.

4.4.2.3 Learning about technology integration

The module consists of teaching students how to plan and teach with the aid of technology. Students were taught through demonstration on how they can integrate technology in their classrooms.

4.4.2.4 Content/Outcome/Module

The module, outcome and content all work hand in hand. This premise refers to how the module is built up as well as of what content the module comprises.

4.4.2.5 Resources available

Resources in this context refer to physical resources which the university provides to the lecturers and the students. For the lecturers, it is the resources which are available in the lecture venues to teach with as well as devices which the university provides them with. For the students, it is the Wi-Fi which is available all around campus as well as the computer centres which are freely available to use.

4.4.2.6 Student learning

Student learning refers to the knowledge and skills students were taught in the module.

4.4.2.7 Lifelong learners

Lifelong learners in this regards refer to the lecturers. Lecturers need to keep in mind that with technology growing at such a rapid pace, there is always going to be something new out there. Lecturers need to be open-minded and willing to learn from students should they discover something which the lecturer hasn't discovered yet.

4.4.2.8 Disparities

Students were asked to assess their peers' assignments. During this process, students noticed the diversity of creativity and thought processes of their classmates. Along with that, they also noticed the different levels of effort which students put into their work.

4.4.2.9 Technology challenges

These are the challenges which students faced while completing the assignment. It ranged from the compatibility of devices to the difficulty of finding and creating resources.

4.4.2.10 Preparation

For each class, the lecturers had to prepare their content and find resources which would aid their teaching.

4.4.2.11 Transparency of the assignment

The assignment which was given to the students had to be completed over three weeks. However, students felt that the instructions of the assignments were not clear enough, and the requirements were rather vague.

4.4.3 SYNTHESIS OF DATA AS PER PREMISE IDENTIFIED

The synthesis includes a combination of results collected from the focus group interview and the survey. Table 13 includes a summary of each theme in the conceptual framework explained given the premise under which it was identified. It includes the premise identified, a synthesis of the data under that premise and the subthemes from where the synthesis was derived.

Table 13: Synthesis of data collected

Premise	Synthesis	Sub-theme
	INSTRUCTIONAL DESIGN	
Teaching strategy	The lecturers made use of various teaching strategies. Some strategies were also demonstrated to students. Students mentioned that they learnt new ways/techniques in which lessons can be presented. Various APPS/Resources were demonstrated to students. Some apps or e-resources have a teacher and learner perspective so students could put how it can be used into context.	Teaching strategies Students engaged Resources Teaching techniques
Transparency of the assignment	Students did not have any complaints regarding the teaching style of the class. However, there was one complaint regarding the assignment. Students mention that they did not know what was expected of them. They were confused about the instructions, and the requirements and rubric was vague	Understanding the assignment
	AUTHENTIC EXPERIENCE	
Peer assessment	Students were given the opportunity to mark their peers' assessments online. They were asked to grade and comment on the assignments they marked. Students mentioned that the online marking process was "fast" and "less time consuming". Additionally, students mentioned that the online marking helped them develop their marking skills, and they learnt how to mark using a rubric. However, there were more discrepancies regarding the peer assessment process. Students found it "challenging" and "marked with difficulty". Students complained that the marking process was not fair, the rubric did not cover everything and "it is not as easy as it looks".	Apps/Resources/ Peer assessment Learnt how to mark Fairness of marking

Premise	Synthesis	Sub-theme
Teaching strategy	The classes which students attended consisted of lots of demonstrations and examples of various teaching strategies as well as APPS/Resources which can be used in a classroom. Where possible, demonstrations were done from an educator and learner point of view, so students experienced both ends. Students said they learnt about different APPS and resources as well as 3D technology. They learnt how to create resources and were exposed to many useful APPS Students learnt about different APPS and how these can be incorporated in a class/lesson. Students witnessed how “easy”, “exciting”, “flexible” and “interesting” a class can be if the technology is integrated with the teaching. In some cases, the students felt that the class was being rushed. Students had the opportunity to learn and discover the various APPS/Resources available out there for them to use	Apps/Resources Demonstrations Positive about technology use Lecturer/class content Teaching techniques Technology integration with teaching
Learning about technology integration	It is important to learn these new skills in technology integration because of the rate at which technology is growing. If used correctly and one is well prepared, technology can work well. It leads to enhancement of a lesson experience and also more interaction with students. There are many resources which are available for teachers to use. It also makes the teaching process easier. One needs to shift boundaries, especially when dealing with the integration of technology in a lesson. Students learnt how easy it is to create a lesson with integrated technology. They learnt how to use the Internet safely and the amount of effort and planning that goes into a lesson incorporating technology. Students also explored the abundance of OER available and learnt how to make OER	Technology integration with teaching Lesson/Lesson planning/ OER
	FEEDBACK	
Student learning	In the module being studied, learning was thrown into the hands of the student’s. They were encouraged to play around and see what was available for them to use. Students were taught how to find and create resources. Students learnt how to incorporate technology in their lessons. They learnt how to use these resources as part of a lesson. Additionally, they learnt how different teaching strategies combined with technology could make a lesson interesting. Students say it can be exciting “using technology as a source of instruction”. They say it makes learning interesting and fun and makes learning more effective. Students, however, have a concern regarding the gap between South Africa and other countries in terms of e-learning. Some felt that if you are using technology, there is nothing one can fall back on. However, lecturers did demonstrate alternatives if there is a malfunction.	Students benefit Positive about tech use Negative about tech use

Premise	Synthesis	Sub-theme
Lifelong learners	Lecturers taught through demonstrations on some occasions showing the students how technology can be integrated into a lesson/educational content. The students response to the lecturer is important. Response/feedback can be given in the form of asking or answering a question or providing feedback on an app or a discovery which they have made. This allows lecturers to see if students understand what is happening in class and also to see if their teaching strategies are working. Lecturers need to be open-minded when receiving feedback from students. Because the module is technology centred, one can never know enough, and there is always something new out there. Lecturers need to keep in mind that they might be able to learn something from their students regarding APPS or resources. Lecturers should be willing to learn from students	Students response Lecturer benefits Student benefits
Teaching strategy	Some students felt that even though they were given explanations and taught through demonstrations, more explanation was needed in some cases, especially when contextualising concepts. Students also mentioned that merging technology with education has its limitations. They did, however, learn how to merge technology with teaching strategies.	Lecturer/ class content
Transparency of assignment	With regards to the assignment students were given, they felt that different lecturers wanted different things (all lecturers were not on the same page). Students were confused with the instructions and said it was "unclear" and "vague". Students say they did not know where to start, and they didn't understand when the assignment was being discussed in class. The instructions were unclear, so there were many differences. A handful of students mentioned once they consulted with the tutor, they gained more clarity on the assignment. Students required more information on what was expected of them. Students tried to understand how others interpreted the assignment as everyone interprets things differently.	Understanding the assignment Lecturer/class content Tutor help Different ways of thinking Understanding the assignment (FB)
Peer assessment	Students were asked to "peer assess" the assignment. The marking process was done online. It allowed students to see what others came up with, opened their minds to new ideas and reflect on their learning Students thought the online marking process was easy, effective, simple, fast, and convenient and made commenting easier. They also felt that not knowing who's work they were marking, made the process easier The students mentioned that they had exposure to marking and learnt how to mark. Some students felt that their peers marked unfairly. Students felt the marker, in some cases, should justify why they graded the way they did. A handful of students found marking to be a challenge. A few students mentioned that some students only briefly read the assignment. They had to be penalised for sub-standard work. While	Student benefits Difficulty in using tech/web Different ways of thinking Fairness of marking Different levels of effort

Premise	Synthesis	Sub-theme
	assessing, students might misinterpret what you were trying to say and vice-versa. Every individual understands and reads things in his own context.	
Disparities	While marking, the students stated that they could see what resources were available out there to use and how everyone used their creativity to get something across. Students noted the creativity of their peers and how everyone had their own way of making a lesson interactive and incorporating technology into the lesson, stating, “some were interesting, and some were boring”. Students mentioned that some classmates put in an effort, while others couldn’t be bothered. They did not even write professionally. The assignments differed greatly. Creativity is not always credited. Each student has different ideas and different ways of thinking, portraying things and understanding how something works	Easy/effective Creative thinking Different ways of thinking Creative thinking Different levels of effort
Tech difficulties	A handful of student’s battled with the technological aspect of the assignment. They struggled to “integrate my educational ideas with technology”. Some found difficulty in finding and creating resources while others found it inappropriate when videos and ad’s popped up. Some felt everything didn’t always work out when needed. Some consulted with the tutor while others asked their peers for assistance. Students found it to be challenging but managed to complete the assignment.	Tutor help Difficulty in using tech/web
	REFLECTION	
Teaching strategy	The lecturers noted that the students’ reaction was positive, however, it was not guaranteed that it was the teaching approach that caused this reaction. Because the students were engaged in the course could mean that the students were intrigued by what they were learning. This is all based on observations of the learners. The module makes use of a lot of teaching styles. Due to this (shift from traditional teaching methods which students are usually used to) the lecturers say “you need to sell the module and be more convincing”. Some of these students experienced these teaching methods for the first time. This caused uncertainty among them as to whether they would be learning something or not. The lecturers expected the students to be more responsive; however, because this was new to students, they did not know how to react in certain scenarios. Lecturers felt that selling the module was more difficult with the bigger groups as opposed to the smaller classes. Lecturers can look back at previous classes and see what works and what does not.	Based on students-POSITIVE Based on students-NEGATIVE

Premise	Synthesis	Sub-theme
Learning about tech integration	The students' attitudes towards technology use were positive based on some of the responses to the survey. They said it enhanced learning and made the lessons fun and interesting. It leads to a greater understanding of content and allows for a more interactive environment and greater engagement between student and educator. The students said that "technology is a tool which can advance learning."	Positive about tech use
Lifelong learning	Lecturers need to be open to students' views, discoveries and suggestions. The nature of technology is that there is always going to be something new out there. One needs to be a lifelong learner to succeed with technology. Lecturers do not only learn from each other; they learn from students as well and are open to their suggestions and see what discoveries they have made.	Life long learner
Preparation	When teaching with technology, one needs to be well prepared. Ons has to ensure that you trial run every last detail before class and try and have an alternative if possible if something goes wrong. The lecturers mentioned that you need to know how everything works in case students have questions, saying "you are trying to role model how they should teach one day."	Teach
Student learning	Students learnt how to plan for teaching using technology. They realised how much work and effort go into planning a successful lesson integrating technology, stating: "If planned properly it can make teaching easier and simpler and more effective and efficient". Students see the importance of learning these skills as the use of technology is rapidly growing. Students said they learnt that there are different ways that learning can take place. One aim of the module is to show students how easy it is to integrate technology in a lesson, hoping that they would then make use of it. The students reflected on the purpose and usefulness of an OER and the amount of resources available that can be used.	Lesson/lesson planning/ OER Technology integration with teaching Positive about tech use
Technology Challenges	Because this is a technology-based module, the students are required to know the basics of using technology. Lecturers noted that some students battled with the basics. If students have confidence in something, they will use it. Some students are not confident enough, especially when using technology in an educational context.	Based on students- NEGATIVE Time Tech difficulties

Premise	Synthesis	Sub-theme
	Students struggled to grasp educational technology. They battled to find relevant APPS and credible, safe, free, suitable and age-appropriate APPS. Students say finding resources was time consuming. They didn't realise how much of time goes into planning a technology integrated lesson, and if they had more time, they would have done better in the assignment. Some students found it overwhelming and struggled with technology, but they took the time to learn. Others thought that because of the technology integration aspect, the task would be difficult to accomplish. Despite the difficulties student's faced, they managed to complete the assignment.	Difficulty in finding resources Difficulty in using tech/web
Disparities	Students reflected on the assignment which they had to submit and peer assessment. Students talked about how each student's assignment was different, and each student had their own ideas. With the scope of technology being so vast, the number of available resources are phenomenal so that each student might have discovered something different. When planning, each student had their own ideas to what strategies and resources they should use. Some students are innovative, creative and interesting and intend to "incorporate an understanding beyond the content of their topic". Others were boring and only completed the assignment for the sake of it. Students made mention that while some of their classmates were dedicated, others left it to the last minute. Professionalism and presentation were also highlighted.	Different ways of thinking Understanding the assignment Creative thinking Different levels of effort
Peer assessment	The students also reflected on the marking process. They found it convenient and thought it was easier to mark because they did not know whose assignment they were marking. Students said "marking is about the reviewing progress" and online marking is a quick way to assess. They said when marking, one needs to be open-minded. Each individual perceives and understands things differently. They complete something according to their understanding. The assessor might understand something different as opposed to what the original intended message was. Students found it interesting to see other's ideas. However, the students felt that some of their peers needed to be fairer when marking. They realised marking was not as easy as it seemed. One needs to mark accordingly and have patience as it takes time. Students felt some marked without reading. They also felt that their peers were too critical when it came to marking and commenting.	Learnt how to mark Easy/effective Fairness of marking
	COLLABORATION	**Sub-theme**
Student learning	With technology advancing at such a rapid pace, there is always something new out there. Students are given the opportunity to play around and discover what is out there to use. Students can share their findings in class. This allows for collaboration to take place between students and classmates and students and the lecturers. Platforms were made available for students to share their findings when they were not in class	Sharing among each other Peer support

Premise	Synthesis	Sub-theme
	Collaboration occurs among peers when asking for assistance, sharing or explaining knowledge. Students get ideas from each other (especially during the peer assessment process). Students collaborate with the tutor when asking for assistance. Lecturers also collaborate with the tutor when the tutors provide feedback regarding what the students told them.	
Lifelong learning	With technology advancing at such a rapid pace, there is always something new out there. Students are given the opportunity to play around and discover what is out there to use. Students can share their findings in class.	Sharing among each other
	ROLE MODEL	
Teaching strategy	Various teaching strategies are used to teach the module. These strategies are taught to students as part of the content and also demonstrated to them in class. It is demonstrated to them in a way whereby students can see how to use the strategy while incorporating technology in a lesson. Lecturers use these teaching techniques with the aim of role modelling it to students so that they can use it in their classrooms. Students were shown alternatives in case something doesn't work out. Lecturers tried to let students see the positive side to encourage and help them gain confidence when using technology in their classrooms.	Teaching strategy which lecturers used Alternatives
Technology integration	Students witnessed how using technology makes a lesson easier. They learnt how to plan for a class using technology and how technology can be integrated into an entire lesson. They learnt how to use other techniques in a classroom and integrate more than one e-resource in a lesson. Students witnessed how technology encourages interaction and student engagement in a class.	Teaching techniques Technology integration with teaching
Student learning	Students were shown various apps and resources which they can use. If possible, it was shown to students from a teacher and student point of view. Students could see how to use it while teaching and how it will be experienced if used as a student in class. Various technological devices were also shown to students. If one is well prepared, technology integration can work well.	Alternatives Technology integration with teaching

Premise	Synthesis	Sub-theme
	ACCESS TO RESOURCES	
Resources available	The university provides lecturers with technology devices for personal use and the lecture venues also have resources such as Wi-Fi, projectors and speakers available. There is Wi-Fi available campus wide as well as in all lecture venues. There is a huge variety of APPS/resources available online. With Wi-Fi available all around campus, downloading apps shouldn't be a problem	Devices Apps/ online resources
Tech challenges	Even though there is such a wide variety of devices available, the devices which students own were not compatible to download all the apps. Some students had to use their own data to look for resources on some occasions. Students feel that using technology could be a challenge because of the lack of computers. They also feel that technology can sometimes be unreliable (however, as mentioned previously, students are shown alternatives when it comes to using technology). Some students struggled to get internet access, thus resulting in them using their own data. All students' devices were not compatible to download all APPS. All apps were not free, and some did not open up. Some students struggled to create resources like QR codes. Making the resources available and uploading content also seemed to be a challenge experienced by students.	Negative about technology use Tech difficulties Difficulty in finding resources Difficulty in using tech/web
Student learning	Students are shown how apps can be integrated in a lesson. It is shown to them from a teacher and student point of view. Students are also asked/ given criteria and asked to find apps/resources. They can share their findings with the class. Students said that they learnt how to use apps/resources in the classroom. They learnt how to create and find resources. There are many out there which are free, fun, helpful and insightful. However, sometimes finding suitable apps and playing around with apps takes time.	Apps/online resources Apps/websites
	TECHNOLOGY PLANNING AND LEADERSHIP	
Resources available	The university encourages the use of technology integration. They provide lecturers with the necessary materials for personal use (e.g. tablets, laptops) and with additional resources in lecture venues. The newer lecture venues have top of the range technology equipment available for lecturers to use. The smaller venues just have a basic projector. The newer lecture venues have plug points under the table where students can charge their laptops/devices. This encourages students to bring their devices to class.	Availability of resources

Premise	Synthesis	Sub-theme
	One benefit for the lecturers is because the university supports technology integration; one will often find an alternative in class in the case of problems.	
Challenges	With the use of technology, there usually is some form of technological malfunction which one will stumble upon at some point. If something does occur, one needs to think quickly and out of the box. With regards to availability, one needs to utilise what is available and make the most of it.	Challenges
	TRAINING STAFF	
Lifelong learner	With the information overload we experience, there is always something new waiting to be discovered. Whether it is a device, programme, app or a website, as a teacher, you have to be a lifelong learner to succeed and educate future teachers.	Lecturers
Content/outcome/module	Structure refers to all people involved in the module- the coordinator and lecturers. Everyone works together to find content to teach, to train on how it can be taught using the latest technology available and making use of all resources available in the lecture venues and what the department provides. The module is designed in a way to demonstrate what is being taught to learners. "Modular way" – subdivides something into smaller parts. The module was designed in this way, and to a certain extent, it might be lectured in that way as well. A student commented, "the tutor assisted me where I did not understand"- the tutor used knowledge and skills to assist students.	Module Tutor help

Premise	Synthesis	Sub-theme
	PREPARING PRE-SERVICE TEACHERS FOR TECHNOLOGY USE	
Content/outcome/module	The module is made up of various “chunks” which make up one outcome. The outcome of the module is to guide students in implementing and using technology in their teaching. The module covers various teaching styles as well as technology and resources, which will assist in achieving this outcome. Students are (sometimes) taught through demonstrations. This module is interactive. The students said that they learnt various teaching techniques as well as how to use technology as a teaching tool (integration of various resources). They learnt how to find APPS and resources which can be used in an educational context. They learnt how to combine theory with technology. They learnt the importance of implementing e and m-learning. Additionally, students were taught and assessed on how to plan/design a lesson using technology. The /student’s said it was useful and easy.	Outcome Content Teaching technique Lesson/lesson planning/ OER Frameworks Lecturer/class content

Table 13 includes a synthesis of the data from the focus group interview and the survey. It is made up of summaries of both the data instruments as well as comments made by both the lecturers and students.

Before the synthesis, a summary of all data was collated and tabulated in an excel spreadsheet. A high-level analysis was done with all the data combined, and premises were identified. These premises were then linked to the themes of the conceptual framework.

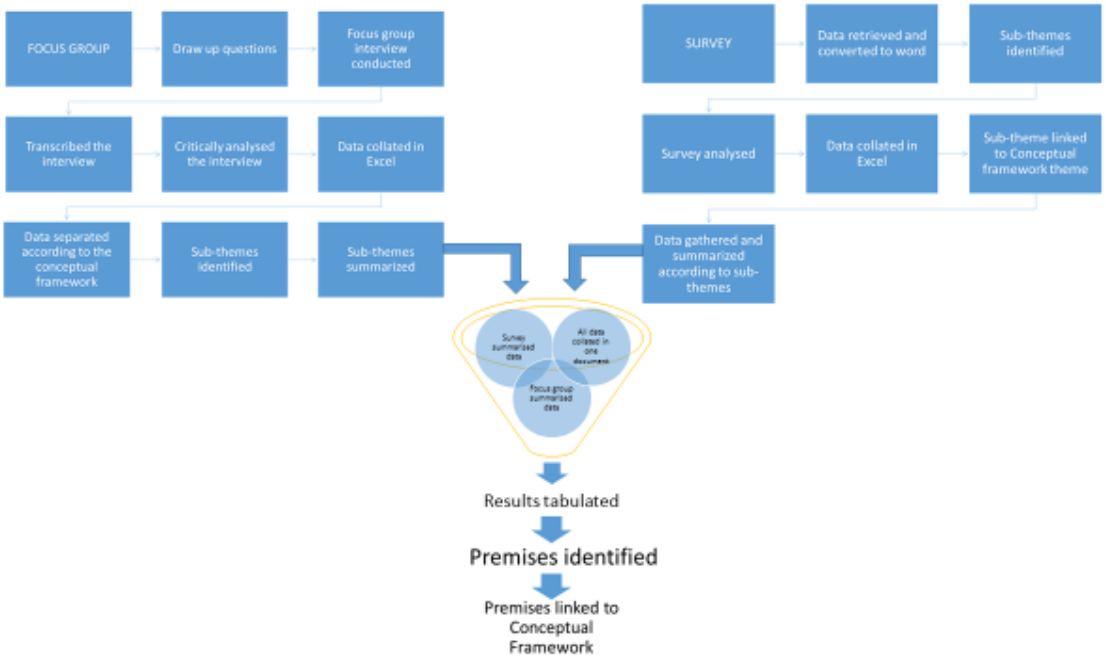

Figure 31: Analysis process of all data instruments which led to the synthesis

Figure 31 illustrates how the two data instruments were combined in order for the analysis process for the synthesis of the data to be completed.

4.5 CONCLUSION

The above chapter discussed the analysis process of the data instruments used, as well as the results of the study. This was unpacked by first discussing the results of the focus group interview, and thereafter, the survey and the synthesis of the data combined.

The next chapter will focus on the premises, which were identified in this study. Furthermore, the research questions will be revisited and the contributions and limitations of the study will be discussed.

5. CHAPTER 5: FINDINGS AND CONCLUSION

5.1 INTRODUCTION

This section presents the discussion of the findings of the study based on the results collected as analysed previously. A mind map was created as a visual representation of how the premises linked to the themes of the conceptual framework. These will be discussed. Additionally, the research questions will be revisited, and the limitations, contributions and future possibilities of this study will be addressed.

5.2 FINDINGS: PREMISE LINKED TO THE CONCEPTUAL FRAMEWORK

Once the data of the focus group interview and the survey was collated and analysed, recurring ideas were identified. These recurring ideas are termed as “premises”. Figure 32 illustrates how the premises are linked to the themes of the conceptual framework

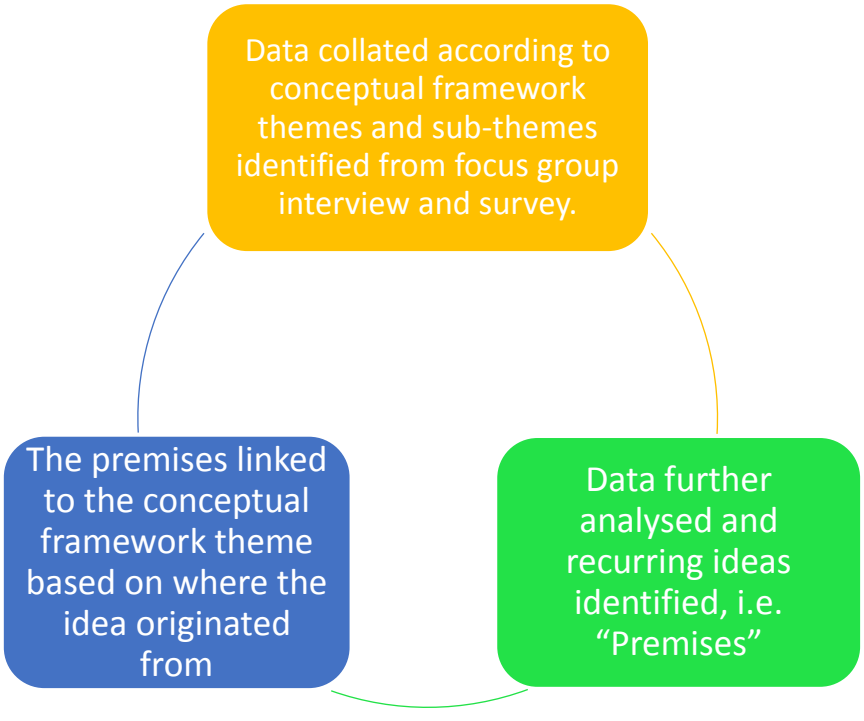

Figure 32: How premises are linked to themes of the conceptual framework

Figure 32 illustrates how the premise identified is linked to the themes of the conceptual framework. The data was collated according to the themes of the conceptual framework and the sub-themes identified. The statements along with the sub-themes were carefully analysed, and premises were identified. The premises were identified from recurring ideas or subject matters identified within the summary of the data combined within each theme of the conceptual framework. In many cases, one premise links to more than one theme of the conceptual framework.

The premises are in no way similar to the themes of the conceptual framework, however, they are underlying values which need to be considered when addressing a theme of the conceptual framework. The premises identified relate collectively to the focus group interview and the survey. However, the way in which the premises are discussed differ depending on where the results were derived from, i.e., from the survey or the focus group interview.

Figure 33 is an illustration of the association of the themes of the conceptual framework and the premises identified. In most cases, a premise was linked to more than one theme of the conceptual framework. The rectangle blocks on the top of the model indicate the themes of the conceptual framework. The colours of the themes are recurring throughout the study. The circle at the bottom of the figure are the premises which were identified. The colour of the arrows indicates to which theme the premise is linked.

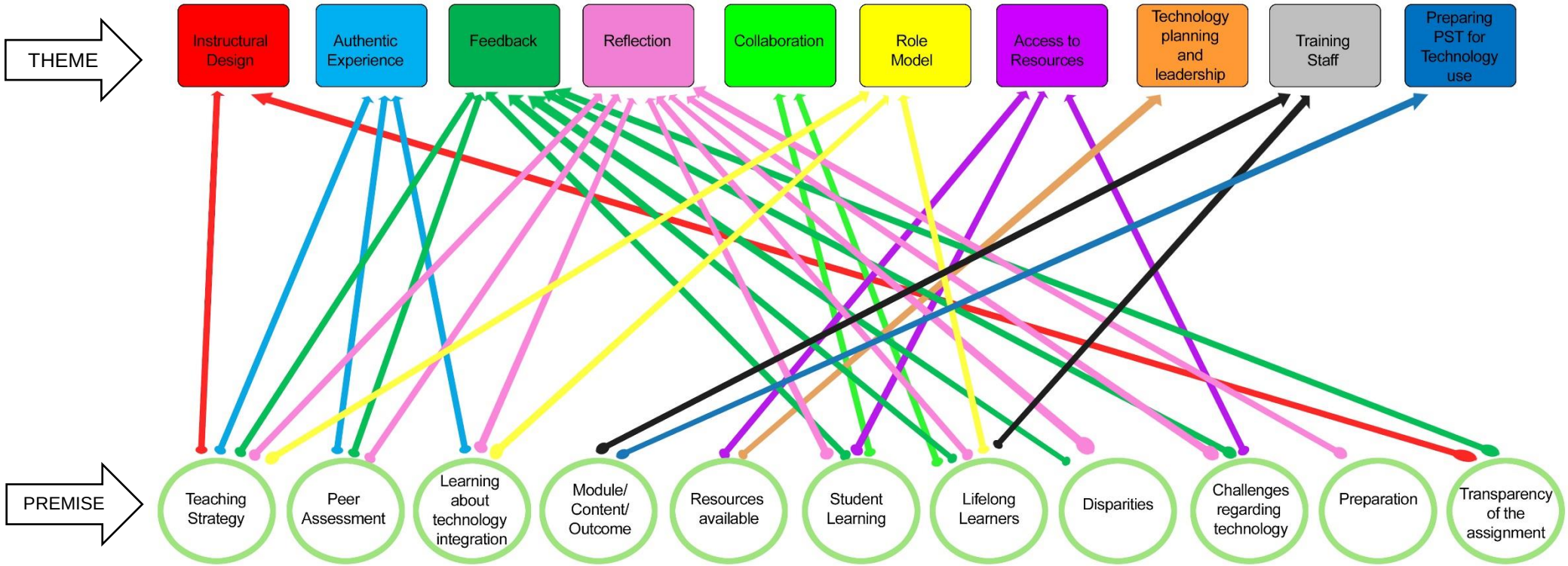

Figure 33: Mind map of the themes of the conceptual framework linked to the premises

Figure 33 illustrates a mind map of the various themes of the conceptual framework linked to the premises which were identified. In most cases, there are more than two premises linked to a theme of the conceptual framework.

In Table 14, the findings of each premise will be discussed. This will be done in accordance with the various themes with which it was linked. The first column of the table states the premise which will be discussed. The second column is the finding discussed as per premise identified, while the third column indicates the themes of the conceptual framework, which are linked to the premise. The findings are based on the themes of the conceptual framework. In table 14, the findings are discussed according to the premise under which it was identified. The findings are based on the results from the focus group interview and the survey, as discussed in Chapter 4, Section 4.4.3. This discussion is a high-level discussion of the mind map, as illustrated in Figure 33.

Table 14: Findings discussed as per premises identified

Premise	Finding	Theme
Teaching strategy	Teaching strategy, according to the premise, refers to the various teaching strategies which the lecturers used in class, taught and demonstrated to the students. According to the conceptual framework, teaching strategy falls under the themes of instructional design; authentic experience; feedback; reflection and role model. Lecturers planned their lessons in a way whereby they could teach using various strategies and demonstrate these strategies where needed. Furthermore, students were shown how technology could be integrated into a lesson while using these teaching strategies. Students were taught through demonstrations on some occasions; hence, they had the opportunity to experience the teaching strategy, which could be used when integrating a type of technology during their teaching. Where possible, students were shown how something could work from an educator's and a learner's point of view. In this way, students had the opportunity to experience how something works from an educator's and learner's point of view. Lecturers tried to teach their class in a way whereby they were a role model for their students who would teach one day. This was done through demonstrations of how different teaching strategies could be used with the aid of technology resources. However, on some occasions, students felt that alongside demonstrations, additional explanation was needed for certain concepts. Alongside demonstrating how technology could be integrated into a lesson, students were also shown alternatives in case something goes wrong while teaching. Lecturers, during their time with the students, encouraged and let students see the positive side of integrating technology in their teaching. Based on the reflection of the lecturers in class, it was noted that the students' reaction towards using technology as an aid was positive, however, there is no guarantee that this was due to the teaching strategy being used. Many students were exposed to new teaching strategies (when being taught) during the course of the module. It was noted that on some occasions, students were uncertain regarding how to respond. A possible explanation for this was the new teaching strategies to which the students were exposed.	• Instructional design • Authentic experience • Feedback • Reflection • Role model
Peer assessment	As part of the module, students had to do a peer assessment on assignments which were submitted on an online system. Students had to assess as well as comment on assignments which were presented to them. This process was anonymous. According to the conceptual framework, peer assessment falls under the themes of authentic experience, feedback and reflection. For many students, the first time they experienced online marking was when they were assigned this task. Students were allocated four random assignments of their peers, which they had to grade and comment on	• Authentic experience • Feedback • Reflection

	over a few days. This process could be done anywhere, provided that there was an internet connection. Students thought this process was fast and easier as opposed to paper-based marking.	
Learning about technology integration	This module aims to teach students how to plan and teach using technology as an aid. Students were taught through a demonstration on some occasions. According to the conceptual framework, learning about technology integration falls under the following themes; authentic experience, reflection and role model. During class, lecturers taught in a way whereby they would like students to teach in their classes one day. They acted as role models to students whereby they would use a teaching strategy along with a technological aid and demonstrate to students how content could be taught in that manner. Lecturers demonstrated various teaching strategies as well as various e-resources which can be used as aids in a classroom. Students had the experience what it was like to be taught using technology as a resource. Where possible, students experienced certain resources from an educator and learner point of view — thus allowing students to experience how one can teach using the resource and how content can be conveyed to students from a learner's point of view. Apart from teaching using technology as an aid, students also experienced how one needed to plan for technology integration in a classroom. Once the module concluded, students realised the benefits of integrating technology in a lesson. Apart from all the planning, which goes into implementing a technology-enhanced lesson, it certainly reaps benefits when it comes to enhancing a lesson and capturing students' attention.	• Authentic experience • Reflection • Role model
Module/ Content/ Outcome	The module, content and outcomes all work hand in hand for teaching the module to be a success. According to the conceptual framework, module/content and outcomes fall under the themes of training staff and preparing pre-service student teachers for technology use. The various personnel involved in the module all work as one entity to make the module a success. The lecturers of the module gather useful information and share their findings among each other. Lecturers need to be up to date in terms of the latest technology available out there for them to use when integrating it with technology. The staff of the module do not go for any formal training as such, however, their knowledge regarding educational technology needs to be kept up to date. The module co-ordinator, as well as the lectures, carefully plan the module to ensure that the latest and most relevant knowledge is passed down to students regarding educational technologies. The various theories which are taught in the module work hand in hand with the type of knowledge and resources which students are taught and to which they are exposed.	• Training staff • Preparing pre-service teachers for technology use

Resources available	The resources which will be discussed under this premise is the physical resources which are available for the lecturers and students to use. These resources include various hardware such as computers, projectors, Wi-Fi etc. According to the conceptual framework, resources available fall under the themes of access to resources and technology planning and leadership. The university strongly supports the integration of technology while teaching. Lecturers are given access to various types of hardware and software both for their personal use and in class. In the lecture venues, lecturers have access to projectors and speakers among other audio-visual resources. There are two projector screens in most venues, so if one screen stops working; there's another screen where content can be displayed. Wi-Fi is available throughout campus as well as within most lecture venues. The lecture venues where the lecturers teach this particular module all have access to Wi-Fi. The lecture venues all have plug points under each seat so students can bring their devices along and charge them if needed.	• Access to resources • Technology planning and leadership
Student learning	Student learning refers to the knowledge and skills which students were taught during the module. According to the conceptual framework, student learning falls under the themes of reflection, feedback, collaboration, role model and access to resources. Students were taught how to integrate technology in a classroom by being exposed to various apps and e-resources, which could be integrated into a lesson. Students were taught how to find, create and evaluate resources. Additionally, they were taught various teaching strategies which could be used while incorporating technology. Where possible, students were shown, through demonstration, how an e-resource works or looks from an educators point of view and a student's point of view. Discovery learning also plays a part in this module whereby students were asked to go and look for apps and resources to share with the class. Platforms were made available for students to share their findings. This process of sharing allows for collaboration among students and between students and lecturers. When integrating technology in a lesson, one has to ensure one plans accordingly. Students were taught how to plan a lesson integrating technology and had to plan their lesson as part of an assessment. Students reflected upon the purpose and usefulness of OER as well as how much of an effort goes into planning a lesson integrating technology.	• Reflection • Feedback • Access to resources • Collaboration
Lifelong learners	Lifelong learners in this study refer only to the lecturers. With technology growing at such a rapid pace, lecturers need to keep in mind that there is always going to be something new out there for them to learn. With this being said, they need to be open-minded and willing to learn from their students. According to the conceptual framework, lifelong learners fall under the themes of collaboration, feedback, reflection, role model and training staff. Due to the nature of the module, one needs to bear in mind that there's always something new out there regarding technology. In some cases, the students might discover or know of something which you do not.	• Collaboration • Feedback • Reflection • Role model • Training staff

	One needs to keep an open mind when interacting with students as they might teach you something new. Apart from students, lecturers can learn from each other when sharing their knowledge and ideas among each other.	
Disparities	Disparities within the study refer to the diversity of knowledge, innovation and creativity among students. Additionally, it expands to the different levels of effort which students put into the assessment which they had to submit. According to the conceptual framework, disparities fall under the themes of, reflection and feedback. Students, during the peer assessment process, were exposed to their classmates' work. The exposure of their work caused them to reflect on how creative and innovative others were. The students saw how one topic could be taught in different ways. Additionally, they were exposed to the various teaching resources available to use in an educational context. During this process, students realised how much time it took to plan a lesson integrating various e-resources. Additionally, they saw how different students put an effort into their assignments.	• Feedback • Reflection
Challenges regarding technology	Different individuals faced different challenges when it came to the use of technology. Sometimes it could be a challenge regarding using a device or sometimes a challenge regarding an app or resource which they could not access. According to the conceptual framework, technology challenges fall under the themes of reflection, feedback and access to resources. With the vast amount of students, there are various demographic factors which need to be taken into consideration when teaching a technology integration module. Students do not all have access to devices which are compatible with some e-resources and only have limited access to the internet to download these resources. Furthermore, due to these factors, some students are not as exposed to technology as others, thus resulting in them not being as "technologically literate" as the others. Technologically illiterate, in this sense, means not being able to complete basic tasks using technology such as searching for e-resources or simply using the internet. As a result of these factors, students struggled with the concept of integrating technology into a lesson.	• Reflection • Feedback • Access to resources
Preparation	For a class to be successful, one needs to be well prepared. According to the conceptual framework, preparation falls under the theme of reflection. Lecturers had to be well prepared for class in terms of which resources they were going to utilise as well as which teaching strategies they were going to use when implementing these resources. Additionally, lecturers also have to prepare for alternatives in case a technical mishap occurs during class.	• Reflection
Transparency of the assignment	During the course module, students were asked to complete an assignment as a form of formative assessment. Students were given an instruction sheet, and the assignment was discussed in class.	• Instructional design

	According to the conceptual framework, transparency of the assignment falls under the themes of instructional design and feedback. The assignment instructions were clear and easy to understand, however, students felt they did not understand everything. The module was split between three lecturers, and each lecturer explained the assignment differently. This caused a lot of confusion among the students.	• Feedback

Table 14 discusses the findings of the premises in accordance with the themes of the conceptual framework. In the majority of the cases, a theme is linked to more than one premise. This could be that they are inter-dependable on each other. However, it does not mean that one needs the other to be a success, but it plays a factor in the success of the theme. For example, the themes of Reflection and Feedback are important driving factors of the majority of the premises identified. There is a possibility that the feedback of the students and the reflection of the lecturers play a role in the improvising of teaching and learning of the module.

5.3 SUB-RESEARCH QUESTIONS

In the forthcoming discussions, the research questions will be revisited and discussed. The findings of these discussions are derived from the focus group interview and the survey.

5.3.1 Sub-Research Question 1

How do lecturers view their role in preparing pre-service teachers for technology use?

The first question of this study sought to determine how lecturers view their role in preparing pre-service teachers for technology use. The findings of this question were based on the results of the focus group interview. Where applicable, relevant links to literature were made. The results can be found in Chapter 4, Section 4.2.2

The university strongly encourages and supports the integration of technology in teaching. They provide lecturers with the necessary resources to integrate technology into their lessons. Apart from lecturers being provided with their personal devices, the lecture venues are also equipped with resources to make the integration process possible for lecturers. Visualizers, projectors and computers are available in most lecture venues. In some cases, if a technological mishap is experienced, the lecture venues provide for an alternative, so teaching can continue as normal.

Technology planning, according to Tondeur et al. (2016) should be:

- Developed together with the various collaborators
- Supported by various parties for technical and instructional purposes
- To empower learners
- Regularly updated

Lecturers collaborate among each other and with the university to ensure that all necessary equipment is available to convey content to students. This technology integration is further supported by the university as well as education innovation. It is used to empower students using teaching and demonstrating to students how technology can be successfully integrated into a lesson.
Lecturers are not sent for any formal training to keep their knowledge updated regarding the content of the module. With the nature of the module, there is always something new waiting to be discovered. Lecturers share their knowledge among each other and in some cases, they even learn a thing or two from the discoveries which the students made in class. Lecturers need to keep an open mind and have the mindset of being a lifelong learner as technology is something which is ever developing.

According to research, a challenge which is being faced is trying to understand the knowledge, attitudes and beliefs of pre-service teachers and how these challenges could affect their futures as qualified teachers (Abbitt, 2011). If lecturers display that despite knowing various techniques of technology integration, they are lifelong learners willing to learn from their students, it might change students' attitude towards technology integration. This can only be achieved through feedback from students.

Feedback is beneficial for the lecturers as it shows them where they can improvise or what needs to change. It is a form of quality assurance. The feedback which students give lecturers can be used to improve the module, and it gives lecturers an idea of whether the content is being understood by students and whether the teaching strategies which are being used are working. According to research, feedback will only be useful if the context it is used in will serve as a learning experience for the recipient of the feedback (Hattie & Timperley, 2007).

This finding confirms the association between feedback and reflection. Feedback is received from students and lecturers take into account what works and what needs to be improvised. Reflection allows lecturers to see what can be adapted in the module for future use. It could be the teaching strategy which lecturers are using, the assignment or the module in general which lecturers could reflect upon and adapt if deemed necessary. The nature of the module requires lecturers to keep an open mind when reflecting upon feedback which was given by students.

The content and outcome chosen for this module were specifically chosen so students can develop the necessary knowledge and skills needed to integrate technology successfully in their lessons. Various frameworks and theories formed part of the theory of the module, which would help students to plan and teach while integrating technology.

Students are exposed to various online resources such as videos, pictures and apps, among others. These resources are used to support teaching and students are shown through demonstration how this can be done. There is very little literature which talks about access to resources with regards to technology integration. However, access to resources, even a computer, is needed for technology integration to be a success.

Lecturers used various teaching strategies in the classroom when conveying content. Teaching strategies include the learner-centred approach, discovery learning, among others. This allowed for students to take control of their learning while the lecturer acted as a “facilitator”. Research shows that educators with learner-centred beliefs are more successful with the integration of technology in the classroom than those educators who are traditional in their ways of teaching (Albion, 1999). This teaching strategy allows for collaboration to occur among students and between students and the lecturer. Students contribute to their learning through class discussions, sharing of information and asking for assistance either from their peers or from the lecturer. Students learn from each other, and in some cases, the lecturers learn from the students as well. The literature says collaboration with peers brings awareness to pre-service teachers in such a way that for peers to evaluate each other, they need to reflect on their own experiences first (Tondeur et al., 2016).

Apart from students being exposed to new teaching strategies, they were also exposed to various resources which they could integrate into their teaching. As mentioned by Tondeur (2012), students should be taught technological skills which can be used in the classroom throughout their undergraduate studies and as opposed to only being exposed to technology when one has to go out on practicals.

Students were given the opportunity to find and create their own resources. Lecturers felt that students should get hands on experience on how to find or create resources as this would empower them to make use of technology in their lessons. Research shows that by providing students with the opportunity for observation and practice of technology integration in the classroom, pre-service teachers' intentions and self-efficacy beliefs will increase (Han et al., 2017).

The module was designed to assist students in building an understanding of the role technology plays in an educational environment. With the experience of demonstrations in the classroom as well as the hands-on experience, students' perception towards technology integration should be positive. Research says that it is vital that the pre-service student teachers are provided with the opportunity to observe and practice technology integration in the classroom. Their experience will determine their self-efficacy and intention of using technology in the classroom (Han et al., 2017). Additionally, Russel et al. (2003) mentions, if educators are exposed to various forms of technology and notice the benefits it comes with when applied in the classroom, their (pre-service teachers.) attitude towards the impact of technology in the classroom might change.

The current study found that the lecturers taught in the manner in which they want students to teach in their classrooms one day. That is, they integrated technology along with different teaching techniques to teach a lesson. Furthermore, alternatives were shown to students in case there happens to be a mishap with technology while teaching. Research shows that for technology integration to be successful in the classroom, teachers need to keep up with the teaching approaches and various pedagogical designs (Krish & Zabidi, 2017). Additionally, according to Hew and Bush (2007), in order for teachers to display good mentorship, three factors are deemed important for it to be effective. These are:

- The educator focuses on content
- The opportunity for hands-on experience
- The technology is consistent with the educators needs.

Based on the above, lecturers display these three traits. The lecturers teach content with the aid of technology while simultaneously integrating technology, thus demonstrating to students how one can integrate technology with teaching. The lecturers make use of multiple technological e-resources during their teaching, thus catering to their needs. All this is done with the main aim of displaying to students how flexible one can be when integrating technology in one's lesson.

5.3.2 Sub-Research Question 2

How do students experience the implementation of technology use in their own practice?

The second question of the study sought to determine how students who had completed the module experienced the implementation of technology use in their own practice. The findings of this question are based on the results of the survey. The results can be found in Chapter 4, Section 4.3.3.

The module that was being studied teaches pre-service teachers how to integrate technology in their classrooms. As part of this, students are required to find or create resources which will support their lesson. Some students were in awe of the number of resources available online while other students struggled to search for what they needed. Research shows that even though students are familiar and comfortable with using technology, they are not sufficiently prepared to use technology in the classroom (Han et al., 2017). The purpose of this module is to teach students how to find and create resources for their lessons. Lecturers teach students how to incorporate technology by using a variety of technological devices and resources.

In this study, students' views regarding the integration of technology differed. All students are not equally technologically literate. While some students' knowledge of technology is plentiful, other students struggle with the basics. That is, they struggle with using the computer or using the internet. While some students saw the benefits which technology integration brings to the classroom, others failed to grasp the idea

of using technology. It was found that this was because students did not have substantial knowledge regarding how to use basic technology.

When planning for the integration of technology in a lesson, one needs to ensure one is well prepared. Students had the opportunity to plan their own technology integrated lesson by incorporating various e-resources which they had to find or create. The planning of the lesson was supported by various frameworks such as the backward design and the TPCK framework. Additionally, students had the opportunity to experience how an online marking system works by assessing their peer's assignments. This exposed students to resources which their peers had used.

Furthermore, students gained insight regarding how much time and effort go into planning a technology-integrated lesson. Further aspects in this study which were reflected upon were the uniqueness of each assignment as well as the different levels of effort which students put into their assignments. Each assignment displayed exclusivity, and it was easily noticeable which students put an effort in when completing the assignment. Research shows that if educators are exposed to different forms of technology and they can see the benefits the students reap from using technology in the classroom, their attitude might change regarding the impact of technology in the classroom (Russell et al., 2003).

As mentioned in the literature review, there is a lack of technological knowledge and skills among pre-service teachers. This causes a barrier for effective technology integration to take place (Hew & Brush, 2007). To fill this barrier, students were provided with additional assistance outside the formal classes. A tutor was available to assist students in the computer labs at the university during a designated time for the most part of the week. These tutor sessions were voluntary for students.

Marino et al. (2009) say that there are three elements which pre-service teachers can adopt to promote learning. These are; multiple means of representation, expression and engagement. This is highly displayed by the lecturers of the module as students are taught how content can be conveyed to them in more than one way when integrating technology. The module makes use of various teaching strategies. Some of these strategies were newly experienced by some of these students. Students had

to learn these strategies, and they were also given the opportunity to watch how the teaching strategy can be applied in a classroom while integrating technology. Furthermore, the teaching approach allows for students to engage among each other, with the lecturer and in some cases with the content as well. The learner-centred approach is the main teaching strategy used to teach this module and adheres to the three elements needed to promote learning.

Students were shown using demonstrating how technology could be integrated into a lesson by using e-resources and various technological devices paired with different teaching techniques. According to Marino (2009), examples of technology integrated lessons should be provided to pre-service teachers so they can build on it and see an example of a technology-enhanced lesson. Students are exposed to technology integrated lessons in every class as that is how the lecturers teach their classes, with the aid of technology.

According to the study, students observed how effective technology was in terms of enhancing a lesson and making the teaching and learning process easier when applied in the classroom. Additionally, students had the opportunity of experiencing how different forms of technologies could be applied with various teaching techniques in the classroom. Research done by Han et al. (2017) shows that by providing students with the opportunity for observation and practising technology integration in the classroom, pre-service teachers' intentions to integrate technology into their teaching increases. Students had the opportunity of experiencing technology integration through demonstrations and hands-on learning during class time. Additionally, students also practised how to plan for a lesson when integrating technology.

5.4 MAIN RESEARCH QUESTION

The main research question of this study queries **"How can pre-service teachers be prepared for technology use in their own teaching practice?"** The findings of this question are based collectively on the focus group interview and the survey, as discussed in Chapter 4, Sections 4.2.2 and 4.3.3.

The module of this study was analysed using the SQD model: Preparing pre-service teachers for technology use based on the principles of Jo Tondeur. The SQD model

states the various factors which need to be taken into consideration when designing a training plan for preparing pre-service teachers for technology use in the classroom. The SQD model was adapted for this study, whereby only the applicable themes were addressed. These include the themes in the red and green circles of the model except cooperation within and between institutions indicated in the red circle.

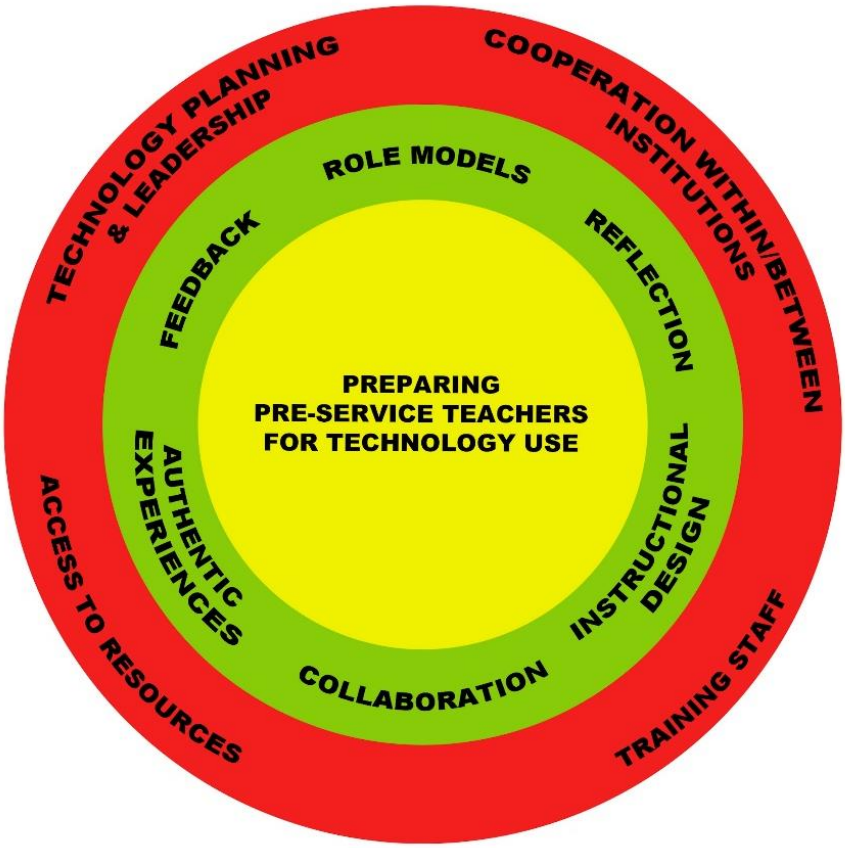

Figure 34: The SQD model as adapted for this study

The study found that all the themes needed to be addressed to successfully prepare pre-service teachers for technology use. Depending on the theme, results were derived from the focus group interview and the survey. The survey mainly addressed the themes in the green circle, while the focus group interview addressed themes throughout the model. There were no new themes which were identified. However, underlying values were identified. These were termed as “premises”

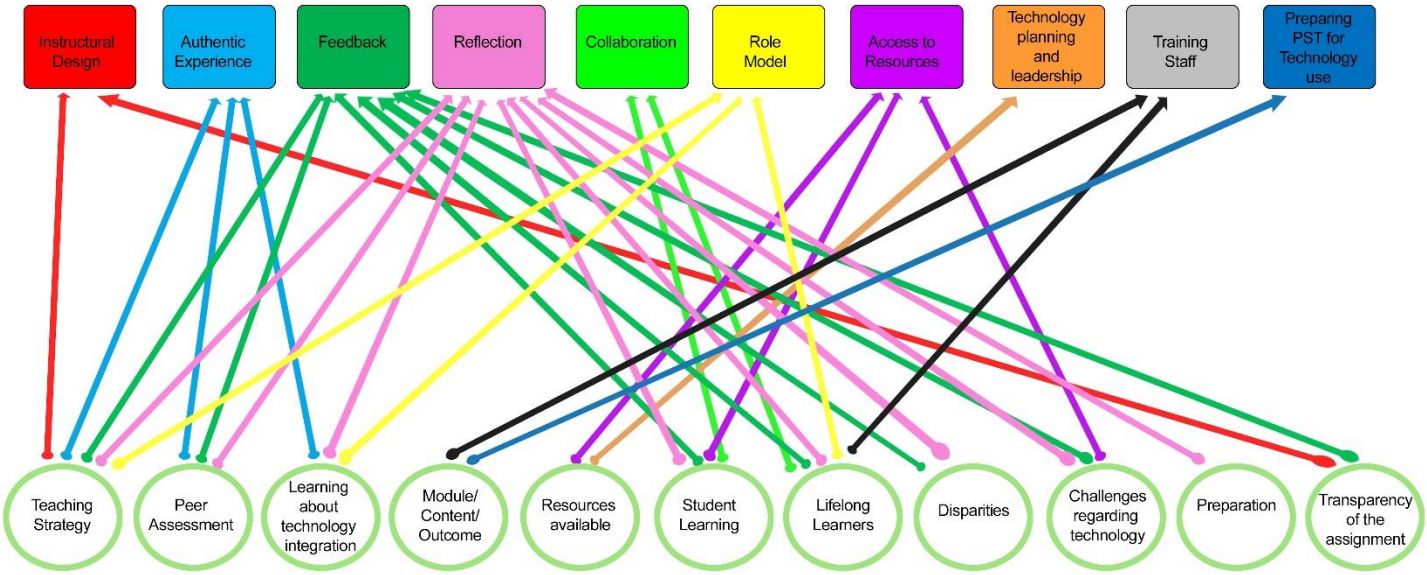

Figure 35: Themes of the conceptual framework linked to the premises

Figure 35 illustrates the themes along with the premises which were identified for this study. In most cases, one premise is linked to more than one theme of the conceptual framework. The premises were identified from recurring statements found in either the focus group interview or the survey. These underlying premises are needed for the themes to be a success.

The themes of the conceptual framework paired with the premises were looked at from a high-level and guidelines were established. These guidelines will be split into two sections, viz., planning a module and preparing preservice teachers for technology use. These guidelines will assist a course or module on what factors need to be taken into consideration when planning for a module with integrating technology.

Section 1: High-level guidelines for planning a module

- The use of Tondeurs framework is a good way to structure and evaluate courses or modules. It includes the major points which need to be taken into consideration for planning a module. The framework will, however, need to be adapted to the nature of the module which one is planning or evaluating.

- There are premises which are linked to the conceptual framework, as discussed in Section 5.2. These premises are underlying values which should be taken into consideration when planning a module along with the points as mentioned in Tondeurs framework.

Section 2: Guidelines for preparing pre-service teachers for technology use

- The content of the module needs to ensure that students are developing 21st-century skills needed to assist them in teaching with technology. Furthermore, content should include frameworks which will guide the pre-service teacher for planning a lesson integrating technology.
- Students should have sufficient knowledge and skills regarding the basics of how to use technology. This will assist and make it easier to grasp the concept of a technology-integrated lesson.
- Sufficient resources need to be made available for both the lecturers and the students for the module to be a success.
- It will benefit students greatly if they get the opportunity to get hands-on experience regarding technology integration. The more involved they are in a lesson, the more positive they will be towards using technology in their teaching. Additionally, it will also boost their confidence when they have to use technology in their teaching.
- Lecturers need to act as role models for students. Students observe how lecturers teach, and this could influence the way they would teach in their classrooms.
- For maximum exposure to technological resources, one needs to ensure that collaboration occurs through different means. Each student makes discoveries of their own; if they each discuss their findings, each student will be exposed to so much more of what e-resources are available.
- Feedback is vital for the module to be a success. Lecturers can take feedback and see what works while teaching. Additionally, it gives lecturers an idea of whether students understand what is being taught to them.
- Be open to learning something new every time you interact with students and colleagues. They might teach you something which could be of benefit to you. In other words, be a lifelong learner.

5.5 CONTRIBUTIONS

The contributions of the study will be discussed in terms of a methodological and practical point of view.

This study made a methodological contribution as it presented a way in which a module can be analysed as a case study. It was critically analysed according to a conceptual framework which was created by Jo Tondeur. The entire study was structured around the themes of the framework, which was used. Data was also analysed according to the themes of the conceptual framework.

The practical contribution of the study provided guidelines for preparing pre-service teachers for technology use. As discussed in Section 5.4, these guidelines will assist a course or subject on what factors need to be taken into consideration when planning for a module with integrating technology. Furthermore, these guidelines can be adapted and used for other methodology modules where the focus is not solely on technology integration.

5.6 LIMITATIONS

This study investigated only one case of the module. In the future, more modules could be investigated with similar content.

The study was based on data which was collected from two instruments, viz., a focus group interview conducted with the lecturers of the module and a survey which students had to complete online.

Additionally, with regards to the survey, how the questions were set was not clear. Due to the ambiguity of the questions and the questions being open-ended, students did not always provide a clear answer. The language, in some cases, was challenging to understand, which could lead to misinterpretation of an answer in some cases.

The current research was not designed to evaluate factors related to technological illiteracy and the demographics among students. However, due to the module being

technology centred, demographic factors need to be taken into consideration among students. This could be a gap which could be addressed in future research.

The current study did not analyse all the themes of the conceptual framework, i.e. cooperation within and between institutions. This study was limited to the university where the module was being taught and did not associate itself with any other educational institute.

The conceptual framework which this study is centred around is the SQD model: Preparing pre-service teachers for technology use. This framework was not extensively applied by other researchers for this specific purpose, thus there is not a great amount of data based on this framework.

5.7 FUTURE RESEARCH

Future research can be done to do a longitudinal study of the same module over a few years. It would be interesting to compare the experiences of individuals who completed the same module over different periods.

The survey questions could be revisited. More clarity could be given to some questions, making it easier for the participant to understand. Furthermore, demographic questions could be included in the survey. This could provide further insight in terms of accessibility to resources.

Further research might explore if the SQD model used to analyse a module in this study, along with the premises identified, could be adapted and implemented in other modules.

5.8 CONCLUSION

For pre-service teachers to successfully integrate technology in their teaching practice, sufficient knowledge and skills need to be taught to students. This can be integrated into their undergraduate curriculum. Various factors need to be taken into consideration to present a technology integrated module. These factors each have underlying values which need to be acknowledged to be successful when presenting a module of such nature. With the rapid growth of technology, educators need to play the role of the “Virtual change agent”. This module can be set up to be a change agent whereby the lecturers who present the module can facilitate an inspiring change for the students, thus, resulting in future educators becoming technology change agents in their schools. Students should be inspired in class and thereafter strive to be an inspiration to others.

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7. APPENDIX

7.1 APPENDIX A

LETTER OF CONSENT **May 2017**

Dear Educator / Student- teacher

Mobile technologies in teaching and learning: E-resource project

A group of lecturers at the Faculty of Education at the University of Pretoria, in collaboration with other researchers, are investigating different aspects of the incorporation of mobile devices to promote innovation in teaching and learning. We request that you participate in this research where we shall explore challenges, developments, implementations and impact of mobile education in the South African context. The specific aspect investigated in this part of the research is the creating, sourcing, evaluation and implementation of electronic resources, linked to the curriculum.

We would like to involve you in this research through the *creating, sourcing and evaluation of mobile applications, in planning innovative interventions that utilize these applications in teaching and in observations, a survey and/or focus groups on experiences with these applications in teaching*. The results of the research will inform educators as well as developers with regard to the selection, use and development of e-resources. It will also give you the opportunity to build your capacity as 21st century educator.

The possible activities will be that you will source, evaluate and/or create resources for your own teaching practice, and/or that you apply it in your teaching, in the classroom setup, or in the online environment. This implies that we would like to track or observe learners'/students' use and experiences of the resources as well.

We shall also provide the learners / students and their parents (for learners younger than 18 years) the opportunity to consent to the research.

Should you agree to participate, please read the following and sign the letter of consent:

- I consent that data and resources can be collected from activities and reflections on the activities, as well as from the survey/focus groups and observations.
- I authorize the researchers to use class/online activities and reflections on the activities, as well as the results from the survey/focus groups.

I acknowledge that:

- I have been informed that participation is voluntary and I am free to withdraw from the project at any time without explanation or prejudice and to withdraw any unprocessed data previously supplied.
- I have been informed that the confidentiality of the information collected will be safeguarded.
- My educational environment as well as I will be referred to by pseudonym or code name in any publications arising from the research.

We look forward to learning with you!

The e-Learning Group

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PERMISSION FOR RESEARCH

I, _____, hereby give my consent for participation in the study. I am assured of anonymity, and know that I can withdraw if I do not wish to participate any more.

Participant Signature: _____ Date: _____

Researcher/s Signature/s:_____ Date:_____

7.2 APPENDIX B

1. What teaching strategy or teaching approach did you use in your class?
2. What was the student's reaction to this teaching approach?
3. Were there any challenges when you were using this learner centered strategies?
4. What support elements do you have in place
5. Positive aspects of your teaching experience
6. Negative aspects of teaching experience
7. How do support the use of technology in your classroom?
8. How do you model what your students should try and do one day
9. So what apps or websites do you use in your class?
10. How is theory and practice aligned in this module?
11. How do you think the module is designed to achieve the outcome
12. As a lecturer in terms of hardware and software, what resources are available to you
13. Lecture venues- what resources are available in there
14. Challenges with the resources available to you?
15. Content based- do you give additional resources over and above what you give them in class?
16. What platform do you share these things
17. And what about click up
18. So what do you use click up for than?
19. In terms of consultation hours, do you offer consultation hours or do you offer appointments for your students or how do you work?
20. If students just pitch up or when you gave them an hour to consult, did they pitch up?
21. So there's nothing in specific which students approached you with?
22. What value does peer assessment have in the module?
23. What do students find difficulty in grasping in terms of content?
24. Do you receive any training in order to teach the module?
25. Personally how did you prepare to teach this module
26. When you were lecturing the module what support did you receive?
27. Did you have previous experience teaching the module?

7.3 APPENDIX C

The appendices for the analysis of the focus group interview will be available electronically saved as “ APPENDIX C- ANALYSIS OF FOCUS GROUP INTERVIEW”

7.4 APPENDIX D

The appendices for the analysis of the focus group interview will be available electronically saved as " APPENDIX D- ANALYSIS OF FOCUS GROUP INTERVIEW AS PER THEMES OF THE CF"

7.5 APPENDIX E

1. Which school phase are you focusing on?
2. Which subject field/s are you focusing on?
3. Share the best apps/websites/resources that you found during your work on the OER Pack . A name, URL and brief description will suffice
4. Describe positive experiences and lessons learnt during Theme 3 about the use of technology in education
5. Share the challenges your experienced during your work on the assignment for Theme 3
6. What did you learn through and about assessment / online assessment during the Peer Assessment process?
7. Please share any other comments or ideas with us. Your valuable input is much appreciated.

7.6 APPENDIX F

The appendices for the analysis of the survey will be available electronically saved as " APPENDIX F- ANALYSIS OF THE SURVEY RESULTS"

7.7 APPENDIX G

The appendices for the analysis of the survey will be available electronically saved as “ APPENDIX G- ANALYSIS OF SURVEY AS PER THEMES IN THE CF

7.8 APPENDIX H

The appendices for the synthesis of data will be available electronically saved as “ APPENDIX H- SUMMARY OF SYNTHESIS OF DATA”

7.9 APPENDIX I

The appendices for the identification of premises will be available electronically saved as “ APPENDIX I- IDENTIFICATION OF PREMISES”