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PH.D.

INVESTIGATING BELIEFS AND EVIDENCE OF TECHNOLOGICAL PEDAGOGICAL CONTENT KNOWLEDGE (TPCK) IN THE TRAINING OF TEACHERS FOR EDUCATIONAL TECHNOLOGY IN MALAYSIAN UNIVERSITIES

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2010

I HEREBY DECLARE THAT, EXCEPT WHERE EXPLICIT ATTRIBUTION IS MADE, THE WORK PRESENTED IN THIS THESIS IS ENTIRELY MY OWN.

WORD COUNT (EXCLUSIVE OF APPENDICES AND BIBLIOGRAPHY): 82,925WORDS

Abstract

This research explores narratives and artefacts that reflect personal conceptions and interpretations about Teacher knowledge and the integration of Constructivism, specifically in the teaching and learning of Educational Technology, in teacher education programmes in Malaysian universities. Two key theories, Mishra & Koehler's TPCK model, and Argyris & Schön's Reflective Learning theory, were utilised as research tools to provide a protocol to acquire, analyse and discuss beliefs and actions about technology in education. Guided by gaps and inconsistencies revealed in reviewed current literature, this thesis produced an adapted version of the TPCK framework and developed a methodological approach to map espoused theories and theories-in-action of reflective narratives and classroom artefacts. New types of teacher knowledge were subsequently introduced with the inclusion of Constructivism into the original framework, allowing closer contextual analysis of how the learning theory was perceived and used when teaching and learning about technology integration. A pilot study explored the feasibility of using the proposed methodological design, subsequently proving its usefulness to capture categories and map findings from the research. A second study was undertaken to capture a larger variety of data at one university. Comparable analyses were produced from both studies, revealing complex relationships between espoused theories and theories-in-action held by teacher educators and their student teachers. Conclusively, the research has illuminated that Technology Knowledge was consistently over-emphasised in the teaching and learning of the observed Educational Technology courses, neglecting crucial exposure to and training of other knowledge types advocated in the TPCK framework. Though deemed highly relevant by participants, the research has also revealed that Constructivism was conceptualised at a cursory level and it was not applied in practice in any of the observed Educational Technology courses.

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Chapter 1: Introduction

1.1 Background to the Study

Technology is ubiquitous in schools today. Teachers have been using technology as part of their teaching and learning process for many decades. Against this backdrop, this study looks at how teachers are trained to use the technology they will encounter in their professional practice.

Weaknesses in the way teachers are educated are oftentimes overshadowed by the more widespread concern to investigate the impact of technology on students and their learning process. Teacher voices are often lost in the process and many problems in the teacher training process are left hidden, undiscovered and neglected. It is reasonable to expect that teacher education would have an impact on any technology integration initiative, because teachers play a vital role in designing, delivering and assessing lessons in the classroom.

The case for this study is situated in Malaysia. As a developing country, Malaysia has been notably ambitious about the promise and potential of technology to have an impact on the National Education System. The country has invested and spent large portions of its annual national budget to put its national technology plan for education into action.

Malaysia provides strong support for developments in technology applications in general, and thus its government plays a crucial part in influencing the level and rate of acceptance and usage of technology in Malaysian classrooms. As articulated in a report on Malaysia's ICT progress in its national drive to create a knowledge-based economy (Department of Statistics, Malaysia, 2002, p.3):

> Malaysia has embarked from a production-based economy to a knowledge-based economy since the year 2000. A Master Plan to chart the strategic direction towards the knowledge-based economy was launched in September 2002. The Master Plan provides a strategic framework outlining the changes to the fundamentals of the economy. Besides an overall socio-political, cultural and security environment, Information and Communication Technology (ICT) has been identified as one of the critical factors for the development of a knowledge-based economy. In terms of ICT benchmark for selected countries, Malaysia is ranked 7th and is classified as being in the

> medium category. Following the establishment of the Ministry of Energy, Communication and Multimedia, Malaysia is now better equipped in terms of institutional, legislative and regulatory framework. Though Malaysia's performance in the ICT sector is emerging, the ICT penetration rate, while better than Malaysia's neighbours (other than Singapore), is only half that of of Australia.

The citation above presents a clear indication of Malaysia's high ambition to embrace technology on a national scale. In general, technology is valued as a tool to radically change the way teaching and learning are dealt with in Malaysian classrooms. Millions of Ringgits (at the point of writing, the exchange rate of 100 Ringgit Malaysia to Pound Sterling is 18.2) have been allocated to the Ministry of Education to advance this cause. The funds are largely spent on purchases of hardware and software. At the height of the technology boom in the country, teachers and schools were given laptops and projectors which are designed to be used in their classrooms, complete with accompanying CD-ROMs which contained teaching materials for selected subjects. By 2003, the ICT facilities provided to schools in Malaysia included computer hardware, software, computer labs/rooms and Internet access (MySchoolNet, 2003). These facilities are fitted to deliver the following specially designed multi-million ringgit projects:

a) Computers in Education project;

b) Computer-assisted Teaching and Learning project;

c) Electronic school project;

d) Smart school project; and

e) Teaching and Learning Science and Mathematics in English project

The levels of success and effectiveness of these projects vary from one setting to another, in parallel with developments in political commitments and financial strengths of the country. The most prominent of these projects is the Smart School project, which was designed as part of the Vision 2020 programme, a national ICT programme that aspires to leapfrog Malaysia into the post-industrial age through use of strategic technologies in focus sectors, namely education, healthcare, commerce, government and manufacturing (Accenture, Markle Foundation and United Nations Development Programme, 2001).

How is ICT in education interpreted by the Malaysian Ministry of Education? According to an official from its Department of Educational Technology (Chan, 2002, p.1):

> Malaysia also has a long-term vision, usually referred to as Vision 2020 which calls for sustained, productivity-driven growth, which will be achievable only with a technologically literate, critically thinking workforce prepared to participate fully in the global economy of the 21st century. At the same time, Malaysia's National Philosophy of Education calls for "developing the potential of individuals in a holistic and integrated manner, so as to produce individuals who are intellectually, spiritually, emotionally and physically balanced and harmonious... The concept of ICT in education, as seen by the Ministry of Education, includes systems that enable information gathering, management, manipulation, access, and communication in various forms. The Ministry has formulated three main policies for ICT in education.

The policies referred to here are:

a) ICT for all students – ICT as an enabler to reduce the digital gap between schools in Malaysia;

b) Role and function of ICT – ICT as a teaching and learning tool, part of a subject, and as a subject in itself (this includes using ICT to access information as well as communication and as a productivity tool); and

c) Use of ICT to increase productivity, efficiency and effectiveness of the management system – ICT as tool for automation and mechanisation of information systems, lesson planning, financial management, and inventory maintenance.

As a continuous professional development initiative, teachers in secondary schools in Malaysia undergo a bachelor's degree programme in education at various local universities in the country. To meet the aspirations of the country to build a technology-literate workforce of the future and, ultimately, to acquire a knowledge-based economy, the national curriculum introduced the use of technology in education. Computers were distributed to classrooms around the country. Annual budgets for technology infrastructure and teacher training are allocated each year, to provide support for the national education system to embrace the advantages of technology for the future. In Malaysia, teacher education programmes are offered by both public and private universities. However, without ample opportunities in teacher training programmes to learn to cope with the growing demands of technology integration in education, teachers are may fail to use technology effectively and efficiently in their lessons. Consequently, in the teacher education programmes, Educational Technology courses are put into operation to train pre-service and in-service teachers from all disciplines to be competent in using technology in teaching and learning. These programmes play a key role in addressing the need to produce ICT-literate teachers who are capable of using and integrating ICT effectively into their classroom instruction.

In summary, it is clear that the use of technology in education is positioned as an important agenda to expand opportunities for quality teaching and learning in Malaysia. The policies listed above suggest that technology is not only regarded as a tool that is integrated into the teaching and learning system, but it is to be studied as a subject matter in its own right. More importantly, these ICT policies reflect a desire and need to use technology effectively in classroom instruction. The strong policy objectives just stated, serve as justification for the importance of this research within Malaysia.

1.2 Problem Statement

To understand how technology is integrated into school classrooms, it is necessary to examine how teachers learn about technology integration in their teacher education programmes. This study investigates how educational technology is conceptualised in teacher education programmes in Malaysia. Teacher beliefs and actions within a teacher education programme are important indicators of their probable actions when they enter the school classroom.

This research attempts to take an insider's perspective in its investigation approach. Capturing an instance of how participants interpret their personal account of teacher knowledge would inform professional practice because it represents the way knowledge is perceived, reflected upon and acted on by teachers. The study aims *to examine if there is any congruence between theory and practice in terms of* *integrating technology in the classroom.* In a similar argument on this issue, Korthagen (2010) reviewed works of other researchers who have identified the cause of what he termed "theory-practice divide." He reasoned that:

> there may be that, for quite some time, there has been a simplistic view of what goes on in the teachers and teaching, caused by the fact that researchers often looked at teachers and schools from the outside, and not from what Anderson and Herr (1999) call an 'insider perspective,' as is common in anthropological research. (p. 99)

He further explained that researchers who went into classrooms and engaged in qualitative approaches were more able [compared to using questionnaire surveys] to capture a realistic description of the "life world of the interviewee with respect to interpreting the meaning of the described phenomena" (p.99). This echoes the approach that has been decided for this study, in order to capture a series of observations of the current teaching and learning anecdotes from teacher education programmes in Malaysia.

Raths (2000) cited work by Kennedy (1997) who claimed that one of the beliefs that teacher candidates bring with them when they enrol into teacher education is "that they already have what it takes to be a good teacher, and that therefore they have little to learn from the formal study of teaching" (Kennedy, 1997, p. 14). Raths further linked Kennedy's position to Bruner's interpretation of the issue. According to Raths, Bruner (1996c, p. 46) argued that most people have acquired what he calls a "folk pedagogy" that reflects certain "wired-in human tendencies and some deeply ingrained beliefs." Bruner further expanded the issue to suggest that "teacher educators, in theorizing about the practice of education in the classroom, had better take into account the folk theories that those engaged in teaching and learning already have" (Bruner, 1996c, p. 46). This rhetoric suggests that there is an impending need to look at how teacher beliefs shape the way they go into training. It has also highlighted the necessity for teacher educators to act on these teacher beliefs during teacher training.

In sum, input from this study is required to understand issues in technology integration in the classroom from the perspectives of individuals who are directly involved in teacher training.

1.3 Aim of the Study

This research focuses on capturing reflections and evidence of practice about the teaching and learning of Educational Technology courses within teacher education.

This study utilises three key concepts – Technological Pedagogical Content Knowledge (TPCK), Constructivism, and Reflective Learning Theory. These three concepts are selected because they represent the main areas of concern in this study. The concepts are essential in providing the context to analyse conceptual understanding and associated evidence in a teacher education setting, specifically within the teaching and learning of educational technology.

The TPCK framework lends itself naturally to the framework of this study because it describes a component of technology knowledge called Technological Pedagogical Content Knowledge (TPCK). The basis of this framework was originally conceptualised by Shulman, who first introduced the concept of Pedagogical Content Knowledge (PCK). The TPCK framework builds on this by explicitly introducing technology; within the study, it offers a logical approach to interpret findings. It does this by providing a language to describe how technology is addressed within a teaching and learning environment, taking into account the nature of content (*subject matter*) and *pedagogical strategies* that have to be considered to produce a well-thought-out lesson. It is not used to limit the idea of teacher knowledge, for example by being taken up as an epistemological claim, but instead is used as an interpretative tool to delineate a limited number of elements of teacher knowledge that are relevant to this study. In an educational technology course, content is typically made from the integration of the three knowledge types (Content Knowledge, Pedagogical Knowledge and Technological Knowledge). The TPCK framework is employed to analyse narratives and artefacts that reflect the engagement with the types of teacher knowledge made explicit in the framework.

Constructivism is commonly included as the pedagogical theory of choice for content that is taught using technology. This study examines the widely perceived relationship between using technology and Constructivist theory. It explores how Constructivism, as a learning theory, has been understood to affect the processes of instructional design and delivery of educational technology courses within teacher training.

This research also employs the Reflective Theory concepts, espoused theories and theories-in-action, introduced by Argyris and Schön (1974), to describe conceptual interpretations and the corresponding actions taken by individuals when dealing with an idea, knowledge, emotion or thought. Concepts derived from these theories are used to explain the nature of espoused theories (beliefs) and theories-in-action (evidence of practice) which are analysed in the research. Reflective Learning theory provides protocol to explain espoused theories and theories-of-action.

Further discussion of all these concepts is detailed in the Methodology chapter.

1.4 Research Questions

The study explores how teachers are trained to use technology. The following are the research questions that will guide the direction of the research.

1. What are the espoused theories and theories-in-action of teacher educators and student teachers that reflect their teaching and learning in Educational Technology courses?

2. What are their interpretations of Constructivism in their teaching and learning in Educational Technology?

1.5 Conceptual Framework

To understand how the key concepts in this study are investigated, it is necessary to visualise how they connect and are put into the context of this study as a whole.

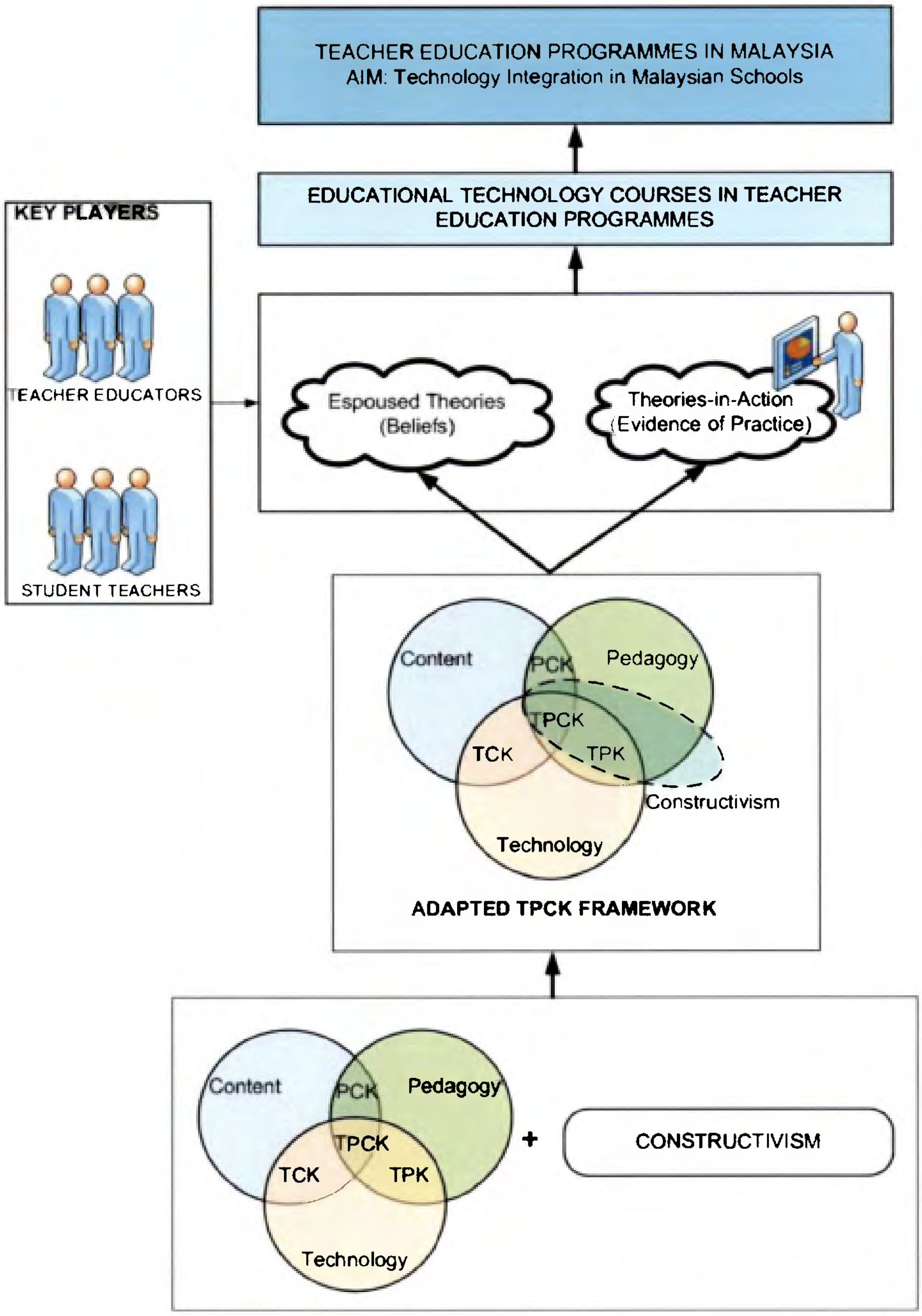

Figure 1.1: The Conceptual Framework

The Malaysian Education System has invested significantly in advancements in ICT to support the development of students, teachers and schools in the country, especially in the last two decades. One of the key aims is to push the standards of learning through the use of technology. Educational Technology courses in teacher education programmes are the primary courses which deal with issues regarding the use of technology in the classroom. In a typical teacher education programme, Educational Technology courses are offered after student teachers have attended courses in their subject matter content. They would have also done at least one course on pedagogy at the time they enrol into the Educational technology courses. Educational Technology courses are typically expected to address issues which directly relate to how technology could be used to teach subject matter content. It should also relate the teaching of the subject matter content using technology with relevant pedagogical theories and applications. To understand issues about the integration of technology in the classroom, it is deemed important to examine teacher beliefs and actions during teacher training. Though this study does not set out to assess an entire course of a teacher education programme, nor to attempt to examine any Educational Technology course in its entirety, findings from this study are expected to provide indicators about issues in integrating technology in school classrooms in the country.

This study is about how these Educational Technology courses are being interpreted by teacher educators and their student teachers. To capture these interpretations, the study employs elements of the Reflective Learning theory, espoused theories and theories-in-action, to differentiate between respondents' beliefs and tangible actions. To categorise the different aspects of knowledge which are expected to be addressed in a typical Educational Technology course, the study employs the TPCK framework to visually map data in the study. The TPCK framework discriminates Subject Matter Content knowledge (Content Knowledge), knowledge about learning theories and pedagogy (Pedagogical Knowledge) and technical knowledge (Technology Knowledge). The TPCK framework also indicates knowledge types which overlap between one type and another, for instance Technological Content Knowledge. This study is keen to discern how participants in the study perceive Technological Pedagogical Content Knowledge in their Educational Technology courses.

One of the conceptions analysed in this study is on the Constructivist theory. This learning theory has been broadly linked to the use of technology in the classroom. Using the same TPCK framework, this study includes Constructivism into its visual conceptual map. The outcome of the inclusion is an adapted version of the TPCK framework, where Constructivism is positioned as an example of a learning theory within the Pedagogical Knowledge category in TPCK framework.

Using the adapted TPCK framework, this study sets out to respond to its two research questions.

1.6 Motivation

The decision to conduct research in this area at Malaysian universities was directly influenced by my professional experience. I have a background in teaching a Teacher Education programme in one of the public universities in Malaysia for seven years, prior to my enrolment into this doctoral programme at the Institute of Education. In the years teaching Educational Technology modules to future teachers, and interacting with fellow teacher educators, I have developed a keen interest in understanding how technology is perceived to enhance the quality of instruction within a teacher training context. My experience informed me that there was an urgent need to understand personal and public conceptions about Educational Technology, from both the teaching and learning perspectives. As a researcher, it was a challenge to study an issue which concerned both educators and their student trainees. Over time, it became increasingly necessary to understand how teaching was conceptualised, designed and developed for the classroom, particularly for training trainees to become fluent in Educational Technology. This was because I could detect gaps in the way Educational Technology was discussed, orally and in written form, by my students and also my colleagues. I want my student trainees to learn better, to develop their competence in using educational technology, and not use technical jargon to mask what they do not know or practise. The government of Malaysia strongly supports the use of technology in education, and in teacher education. There is national-level concerted effort to open a platform for teacher educators and their students from various teacher education programmes to learn, collaborate and communicate with each other. It is hoped that this research will uncover the similarities and differences in perceptions, beliefs and actions of fellow teacher educators and the student teachers who are studying under their tutelage. I hope the outcome of this research will be a useful point of reflection for dialogue in this field of study. I am determined to find strategies to understand issues that impact the teaching and learning of Educational Technology more effectively and systematically, so future student teachers will be able to benefit from better curriculum design and improved quality of instruction. Subsequently I hope that, with well researched knowledge on how to improve the quality of teacher training, particularly in the teaching of Educational Technology courses, student teachers will have a sufficiently informed opportunity to improve their discourse and dialogues about Educational Technology, and consequently become more competent in integrating technology effectively in the classroom.

Conducting the research in Malaysia is important to me, because, in addition to making a contribution to an important piece of public policy, the experience will serve as a significant professional development opportunity in my home country. I have gone through many years in the national education system, and in my current position as a teacher educator, I am now able to contribute to the betterment of the national education system. The research is a valuable opportunity to examine how teacher knowledge is developed in teacher education programmes in the country. The findings will provide an insider perspective into how teacher educators and their students relate their personal conceptions of educational technology to the way they use technology in practice.

This research will also investigate the way Constructivism is used in the teaching of educational technology. Since I first studied about the Constructivist theory in my Masters programme at Penn State University, I have always been intrigued by the way the theory has been translated to justify and to fit in with technology-based teaching. This research is an opportunity to explore this issue in depth, and to understand how much Constructivism as a learning theory has affected the way educational technology is taught in teacher education programmes.

The key problem that motivated the inquiry of this research was a result of reflecting on years of accumulated experience where I have observed how my students dealt with their Educational Technology courses. I reflected on the way they translated the theoretical knowledge they learned in my classes into action. When they complete their university studies, they always reported on how their personal expectations and interpretations of their own learning experiences when studying about Educational Technology did not match the realities of the classroom. For example, in various personal conversations, a number of my students described how they conceptualised technology.

a) It is a tool to evoke excitement in the classroom (it is a "fun tool", and it helps to eliminate boredom and monotony in the lessons).

b) It is a presentation tool (it provides an efficient way to present information to students, and they quoted examples of using PowerPoint slides to show pictures and text to students).

c) It allows them to show off their technical skills to other teachers and students.

d) It is an expensive facility in the school and teachers should be extra careful about using it in their classroom (this stems from a government circular that makes teachers directly responsible for each technology tool assigned to them in their classroom).

e) It is a hassle, because teachers are oftentimes made to attend technology training, and consequently have had to leave their scheduled class sessions for long periods of time, and this has negative consequences for their job because most schools require the teachers to complete the yearly syllabus (for some, the backlash is more detrimental, because their students would not be fully prepared for their final year-end examinations as their teachers were not able to conduct class sessions as scheduled).

f) It is a promotional/advertising tool that is used occasionally, when there are important visits from government officials and so forth, to show how 'technology-integrated' their schools are (the teachers coined the term 'minister-ware' to denote the use of technology only for demonstration purposes when a government minister or political figure comes to visit their school).

g) It is burdensome, because a large number of teachers have had to sign a liability clause with their school authorities, as assurance for any technical mishaps that may occur during the times the computers are in their classrooms.

h) It is a wasteful investment, because teachers are pushed to use technology because it is available in the school, without much consideration for the extra effort that teachers need to put in to learn to use the tools

The aspect that piqued my curiosity was that the students' perspectives were like chalk and cheese with those of their own course instructors at the university. While the teacher educators were more concerned about the pedagogical issues in the use of technology, these learner perspectives reflect concerns that directly relate to the technical knowledge of using technology. Consequently, the accumulated frustration over time in dealing with the mismatch of expectations and efforts between the interest of the teacher educators and the perceptions of student teachers has driven me to pursue research in this field.

This research opens an opportunity to review, reflect and reassess good, sustainable practices in the teacher education field. My personal goal for this research is to build my competence to provide ideas to inform future directions in developing quality teacher training programmes for teachers in Malaysia.

1.7 Limitations

These are the known limitations of the study.

1. The pilot study was done at only two universities: one used the conventional four-year residential format, the other used distance learning format for instruction. The main study was done only at one university, which used the conventional four-year residential format of instruction. Justifications for the decisions to use these universities are offered in the corresponding chapters.

2. The study was conducted at teacher education programmes at university level only.

3. There are two types of participants in this study. At the time of the study, the teacher educators were practicing Educational Technology instructors in a teacher education programme in Malaysia. The student teachers were registered and enrolled into a teacher education programme in Malaysia. They were studying an Educational Technology course at the time of study.

4. Only teacher educators and student teachers who were nominated by the researcher's contact points at each university were involved in the study.

5. The artefacts collected in this study were self-selected by the participants.

6. The participants were bonded to respond to the interview questions during the duration of each interview session only.

7. The beliefs of participants captured in this study were as recorded during the time of interview only.

1.8 Assumptions

The following assumptions were made throughout the course of the study.

1. Participants responded truthfully to the questions in the interviews.

2. Class artefacts given by the participants are actual project work of the students for the Educational Technology courses they were in during the time of study.

3. Teacher educators have asked for permission from their student teachers before copies of their course projects were sent to the researcher for analysis.

1.9 Operational Definitions

The term technology is used in this study to refer to the use of information and communication technologies (ICT) for teaching and learning purposes in a classroom setting.

The term belief is used to indicate espoused theory (as advocated by Argyris and Schön). Belief is used to refer to the articulated knowledge and experience that participants hold regarding issues investigated in this study.

The term **practice** is used to indicate **theory-in-action** (as advocated by Argyris and Schön). Practice is used to refer to the performance of action by participants that corresponds with issues investigated in this study.

The following definitions are from Mishra and Koehler's definitions for their TPCK model (2006).

1. **Teacher Knowledge** represents the constructs of knowledge that a teacher would engage in when teaching. In the context of this study, the concept of Teacher Knowledge is partially addressed because the main contention of the study is on the subsets of Teacher Knowledge which are identified in the TPCK framework.

2. **Content Knowledge** represents subject-matter discipline knowledge, such as Mathematics, Science, Geography and so forth.

3. **Pedagogical Knowledge** represents instructional knowledge, encompassing understanding about educational philosophies, beliefs, approaches and delivery strategies that help an educator to design and deliver effective instruction.

4. **Technological Knowledge** represents comprehension about technical facts and skills related to one or more technology tools or systems.

5. **Pedagogical Content Knowledge** represents the integration of Pedagogy and Content knowledge, where Content Knowledge is delivered using appropriate Pedagogical principles to match the Content being taught.

6. **Technological Content Knowledge** represents the deployment of appropriate technical knowledge and skills that match the characteristics of the Content Knowledge.

7. **Technological Pedagogical Knowledge** refers to the integration of technical know-how with pedagogical constructs. It reflects that adaptation of appropriate features in a technical gadget or system that can enhance pedagogical qualities of instructional delivery.

8. Finally, **Technological Pedagogical Content Knowledge** refers to the integration of all three major sectors in the TPCK model. The integration creates an instructional instance which considers the best possible pedagogical construct and appropriate technological features to enhance the learning of selected subject-matter content.

1.10 Structure of Study

This study uses a qualitative approach in its research design. The content of this thesis is structured to expound on the investigation process which the study has been based on.

The three chapters following this introductory chapter present analyses of previous literature, which focused on key issues investigated in this study.

a) **Chapter 2: ICT in Teacher Education & The Concepts in Teacher Beliefs and Practices**

This chapter provides an overview of current thoughts, trends and practices of ICT use in higher educational institutions, particularly for teacher education. This situates the study, using the analyses of global trends in the way technology is dealt with, by looking at a specific focus on its impact on teacher education. This chapter also looks at the two key concepts in this study, beliefs and practice, specifically in the context of teacher learning.

b) **Chapter 3: Treatment of Pedagogy, Technology and Content in Building Teacher Knowledge**

This chapter looks at issues of teacher knowledge. It reviews the way teacher knowledge is handled in schools and teacher education programmes. This represents an important segment of this study, because it frames how knowledge construction for teachers is dealt with within the school environment and also in teacher training programmes. It also discusses the epistemological position of knowledge and how knowledge as a process of knowing is treated in the context of this research.

c) **Chapter 4: Reflective Learning and its Relationship with Teacher Knowledge and Constructivism**

This chapter discusses elements of Reflective Learning theory, and how they are used in the design of the research framework for this study. The chapter also highlights the relationship between Teacher Knowledge and Reflective Learning theory. It also discusses issues in Teacher Education, particularly where Constructivism was used for technology-aided learning in teacher education settings.

Chapter 5 presents the research design. It discusses methodology issues such as description of participants, sampling procedures, instruments and data analysis procedures which will be employed in this research. It includes a discussion of motivations behind and justifications for the use of the conceptual framework selected.

Chapters 6 and 7 present the analyses from a pilot study consisting of two case studies, to test the viability of the interview questions designed for this research. The two case studies illustrate how hidden narratives are revealed through a series of interviews with teacher educators and student teachers from two participating universities. Analyses from the pilot study data suggest that the research design planned for this research is sound and reliable. Findings from the pilot study reveal multiple layers of narratives about the issues pertinent to this research.

Chapters 8, 9 and 10 feature three case studies which, together, form the main study for the research. The main study was conducted at a public university in Malaysia. Each chapter describes how one of three different instances of Educational Technology courses was taught at the participating university. Collectively, the three case studies illustrate how teacher knowledge was translated into action. The studies demonstrate how narratives and evidence of practice showed incongruence in the way technology was perceived within the teacher training setting.

Chapter 11 synthesises findings from the main study. Data is mapped using the adapted TPCK framework. The data analysis procedure is further developed in this chapter, to combine, compare and understand how aspects of teachers' knowledge are addressed in all case studies. The chapter also revisits the two research questions, providing a response based on findings brought to light by the research.

The final chapter revisits the issues which were developed throughout the course of the research. It explains limitations of the study and plausible steps to further develop the methodological approach employed in this research. It also proposes potential areas to explore in further research, and discusses the possible impact that this work could have on various areas of interest related to teacher education.

1.11 Summary

The purpose of this chapter is to provide an overview of this research. It introduces key issues in the research. The chapter has presented the two research questions which will guide the execution of this research. It also describes the researcher's personal motivation to conduct research in this area, and concludes with an overview of the content of the ensuing chapters.

Chapter 2: Literature Review 1 - ICT in Teacher Education & Issues about Teacher Beliefs

This chapter is made up of two parts. The first part provides reviews and analyses of mainstream literature on the impact of technology in current teacher education settings. This is to provide an understanding of current contexts of the roles and uses of technology in education, particularly in the training of teachers, who are expected to become technology advocates in schools. The second part examines literature about teacher beliefs. The purpose of the review is to understand why teachers' espoused theories are significant in teaching performance, particularly when teaching using technology. This broad-based literature review does not adequately represent every underlying concern regarding teachers' use of technology, but it is representative of the literature covered within the scope of this research.

2.1 ICT and Teacher Education

Computers are becoming more accessible in classrooms around the world. There are numerous broad claims about radical changes and effects due to the increased presence of technology in classrooms (Cuban, 2001; Oppenheimer, 2003). With the advancements in software applications to constantly match improved computer hardware and tools, plus the continuous insistence for educators to use technology in their classrooms, ICT is no longer a foreign concept in educational systems around the globe. ICT has been heralded as having enabled teachers, students and school administrators to multitask and create a wide range of managerial and instructional products, faster and more easily, thus enhancing communication. ICT is generally perceived as an essential tool in the teaching toolbox, and an aid for a teacher's personal career development (Kirschner & Selinger, 2003; Mishra, Koehler & Zhao, 2006). Bates (2003) predicts that the web will continue to become the dominant educational technology of the future. Teachers' professional practice is undoubtedly affected by the deluge of new demands made by ICT (Wheeler, 2001).

Teaching involves a complex balance of knowledge, skills, experience and attitude. It is:

> one of the most demanding social activities in our society, involving the presentation of a sophisticated cultural inheritance to a large group of learners

> while working within the constraints of a heavily bureaucratised National Curriculum. (Scrimshaw, 1997, p.1)

Teacher education programmes are designed to prepare teachers to be competent in their instructional delivery skills. They provide adequate opportunities to acquire the necessary knowledge, skills and experience, in addition to a chance to adopt the appropriate attitude to teach effectively in the classroom. With new skills in information management that are deemed crucial for survival in this digital information era (Bates, 2003), teachers are expected to rise to the occasion and be competent to design and handle lessons that address the growing interest in computing technology. According to Wetzel (2001), who did a study on factors that influence teachers to implement and integrate technology in their classroom:

> A teacher's epistemology is a product of his/her own prior knowledge, development, and experience as a teacher. Each teacher's teaching style is influenced by personal factors, including his/her personality and belief system. But all teachers' styles are influenced by the context of the organisational structure in which they teach. For instructional technology to be successfully implemented, teacher beliefs and values need to shift. If not, the desired implementation and integration of instructional technology in education will not occur on a broad scale. (p.5)

The push to adopt and adapt to the technology culture has put educators in a challenging situation, in which they are expected to jump onto the technology bandwagon, and immediately start making changes to their instruction delivery and content, using technology tools available to them. However, not all educators have accepted the use of technology in schools with open arms (Bradley & Russell, 1997), citing sources of setback such as anxiety, lack of support and training, to list a popular few.

Historically, using technology in teacher preparation programmes is not a new venture. To illustrate the evolution of technology use in teacher education so far, it is worth noting Cheng's assertion that there has been worldwide educational reform since the 1970s and this has challenged the field of teacher education, particularly in applying ICT in its programme content and developments (Cheng, 2004). Cheng suggests that it happened in three waves.

Briefly, the first wave was on teacher internal effectiveness, which happened in the early 1970s; the second wave was on interface effectiveness, which came about in the early 1990s; the third and final wave took place at the turn of the twenty-first century, when concerns lifelong learning, global networking, international outlook and the increased use of ICT which began to materialise. The first wave of educational reform took shape when emphasis was placed on increasing the quality of teacher effectiveness, in terms of improving the teaching performance of each educator. The main concern was to develop the teaching methods and processes involved in teaching and learning. The end product was achievement of planned educational goals, in that the increase of teaching quality would enable students to acquire desired educational outcomes. The second wave of educational reform looked at interface effectiveness, which meant it focused on educational quality in general, stakeholder satisfaction and market competitiveness. It concentrated on the development of teaching and its immediate environment, and the way external environmental factors communicate and affect teaching quality. In the third and final wave, the educational reform was triggered by concerns about extending educational opportunities for lifelong learning. Cheng's differentiations present the evolution of issues and challenges faced by the teacher education field in the past three decades. She introduced the concept of 'triplication,' which deals with the idea of globalising, localising and individualising a teacher's professional learning and development, in parallel with developments in ICT. She further suggested that teacher education curricula should be reassessed to find out if they address the concept of triplication. She also suggested that history has shown how the concept of teacher effectiveness has evolved and changed through the different demands of time and contexts, especially in the last three decades. To ensure teachers remain relevant in their professional careers, Cheng suggested that teacher education programmes should look at opportunities to provide adequate and effective training programmes that aim for *total teacher effectiveness*.

In an online report by the US Department of Education (2000), it is observed that "teachers' preparation and training to use education technology is a key factor to consider when [they] examine their use of computers and the Internet for instructional purposes". A similar recommendation from the Panel of Technology, submitted as part of an online report to the US President (Shewey, 1998), stated that, "...what teachers actually need is in-depth, sustained assistance as they work to integrate computer use into the curriculum and confront the tension between traditional methods of instruction and new pedagogic methods that make extensive use of technology" (p. 1). In a UNESCO planning document for ICT in Teacher Education (2002), three core principles were listed.

a) Technology should be infused into the entire teacher education programme.

b) Technology should be introduced in context by being used appropriately in courses taught in the teacher education programme.

c) Student teachers should experience innovative technology-supported learning environments in their teacher education programme, in that they are given ample opportunities to use technology applications in practical classes, seminars and assignments.

These statements amount to a strong signal for the need to train teachers to use technology within teacher education programmes. Many studies in recent years have attempted to justify the use of ICT in education. Findings have varied from those which described very positive outcomes to the learning process, to very negative acceptance levels perceived in teachers and learners alike. However, from another perspective, various studies have revealed concerns about the unpreparedness of many teacher educators to use technology in their teaching (Albright, 1997; Caffarella & Zinn, 1999).

Integrating technology would have several effects on the roles of teachers. In an initiative to understand the impact of technology integration onto teacher roles, the teaching profession, and the educational labour market, a study was undertaken in the Netherlands in 2005. Volman (2005) reported a number of perceived impacts gathered through a study of thirteen stakeholders in the field of Educational Technology in the country. The impacts identified included a key observation that a teacher's role will become more complex rather than simpler, with the use of technology. The teacher will become a 'supervisor of learning processes rather than a conveyor of knowledge, but will also fulfil a broader range of roles'. The teacher's tasks would be more varied, as they would include 'instructing, coaching, training, advising and testing' and simultaneously dealing with their students' varied paces of learning. The study also revealed that teachers are expected to collaborate with their peers to a greater degree. They would have to include other professionals in related fields in their collaborations. Analysis of this study directly indicated how a teacher's conventional role is increased tremendously by the incorporation of technology into teaching. Echoing similar concerns, a study by Niederhauser and Stoddart (2001, p. 15) asserted that "Computer technology in and of itself does not embody a single pedagogical orientation...different types of software can be used to address different educational goals" (p.15). Salomon and Perkins (1996) displayed comparable apprehension about the use of technology in education, in that they believed "the thinking on ICT in education should not be determined by what is technically possible, but rather by which ICT applications can improve learning processes" (p. 15).

In applying ICT, Leidner and Jarvenpaa (1995) suggested that, to use it effectively, one strategy is to use an activity centred design/constructivist approach, which places more control and emphasis in the hands of the learners. They suggested this strategy to use technology in learning would:

a) redraw the physical boundaries of the classroom;

b) enable more teamwork;

c) allow learning to be a continuous time-independent process; and

d) enable multi-level, multi-speed knowledge creation.

Their list advocates a positive stance on how ICT could potentially increase the commonly perceived scope of learning experience.

All of these studies have focused on issues related to teacher educators. In a teaching scenario, students also play an important role. Hence, an interrelated question is warranted: "How do student teachers deal with using ICT in the classroom?" Murphy (2000) conducted a study on a Postgraduate Certificate in Education (PGCE) course in the UK, between 1996 and 1997, and found that there are three main reasons why student teachers were reluctant to use ICT in their classrooms. Firstly, there was limited access to computing tools; secondly, the policies of the teacher training providers inhibit the scope of technology use; and finally, there was a lack of encouragement to use ICT in their teaching practice sessions, which resulted in poor confidence to use ICT for their lessons when they graduated from these teacher training programmes. Murphy replicated the same study three years later, and saw remarkable changes in the way ICT was accepted by the student teachers in the 1999/2000 cohort. They appeared more confident and creative in using technology in lessons. Murphy also found that female and younger student teachers tended to be less successful than their male and older counterparts in the programme. At the end of her study, she suggested that teacher training providers should reassess their ICT policy for these teacher education programmes, as it affects the development of skills, attitude and confidence among student teachers in these crucial training programmes. While Murphy's study reflects a localised assessment of a teacher education curriculum with regard to ICT acceptance among its student teachers, it does not reveal factors that affect reluctance or uptake to use ICT tools among the student teachers, nor whether the way the teacher educators taught their courses had any effect on the students' levels of ICT acceptance.

There is a notable report that examined and identified areas for research on teacher education by Cochran-Smith (2005), which proposed that more research should concentrate on (partial list):

a) Outcomes of teacher education, with some focus on the impact of preparation from the time teachers enter teacher training programmes;

b) Inter-relationships of teacher education strategies and arrangements (focus on what teachers actually learn, how they use knowledge in schools and classrooms, and how much their students learn from them); and

c) Outcomes of preparing teachers in subject areas and grade levels.

The partial list of research above implied that there is a need to closely analyse the influence of ICT on the instructional design and delivery of teacher education, crucial to the process of improving and updating the Teacher Education agenda. Though the same report also suggested that research on Teacher Knowledge has been the focus of many studies, there was no specific mention of efforts to examine the relationship between Teacher Knowledge and the integration of ICT in the classroom.

While observing the goals of many teacher education programmes, Duran (2000) revealed that there is a conscious effort to help future teachers to perceive technology as meaningful, authentic and necessary for their work. His study illustrated how pre-service elementary teachers were not given the experiences needed to use information technology in their future classrooms. He further suggests an increase in technological proficiency among these new teachers, and for the level of information technology integration to be increased in the methods and curriculum design courses, a necessary expansion from the dominant exclusivity of use in technology courses only.

There are numerous studies which have focused on similar issues about the inadequacy of knowledge and skills on the part of the teachers to handle technology in the classroom. Resnick (2002) argued that though the focus on information has made computers and education appear 'perfect' for the commonly perceived information acquisition process, the perspective also 'limits and distorts' the way information and knowledge should be viewed. Resnick further built on Piaget's belief that:

> Learning is not a simple matter of information transmission... teachers cannot simply pour information into the heads of learners... Learning is an active process in which students construct new understanding of the world around them through active exploration, experimentation, discussion, and reflection... people don't get ideas, they make them... the ultimate goal for the use of technology in education is to build a society of creative individuals who are constantly inventing new possibilities for themselves and their communities. (pp. 32-37)

Prior studies have shown how research in the area of teacher use of technology is concentrated on the technical usage and skills of the teachers (Byrum & Cashman, 1993). Davis (1999) proposed that three interacting principles underpin the application of ICT in teacher education, namely; pedagogic considerations, technical considerations, and networking and collaboration considerations. She further asserted that teachers should be trained to use technology to increase their own professionalism, and not to acquire technology skills and assume the role of a computer technician in the classroom. She also stipulated that teachers should be encouraged to be more independent and assume more responsibility in their own learning pathways. This independence, she believed, would lead to making the teachers more committed and confident to use technology in their classrooms. Davis' perspective is valuable because it highlights the potential of the teacher, instead of the technology. Her conception of the relationship between teaching and technology is distinctly different from most research initiatives in the field, which have tended to focus on capitalising on the potential of technology, rather than looking at the development of teacher professionalism in congruence with technology integration.

2.2 Teacher Beliefs

To understand how teachers engage in teaching, it is useful to look at how teacher beliefs affect what, how and sometimes, why they teach.

Beliefs are personal to an individual. They represent ideas that a person holds based on personal experience, knowledge and wisdom. In a doctoral thesis, Awenowicz (2009) synthesised definitions offered by leading thinkers in the field (Nespor, 1985, 1987; Eisenhart, M., Shrum. J., Harding. J., & Cuthbert, A. (1988); Goodman, 1988; Hollingsworth, 1989; Pajares, 1992; Kagan, 1992; Richardson, 1996; Tatto, 1998;). She drew on the similarities in the notion about 'belief' and offered this definition:

> beliefs are conceptual systems that help an individual make meaning of aspects of his or her environment; are constructed from personal or shared experiences, can be extended from socio-culturally shared knowledge with affiliated groups or communities; are compelling and emotionally charged; are very often not articulated but used to guide behavior and thinking, and most importantly, are firmly and deeply entrenched. (Awenowicz, 2009, p. 14)

Before teachers became teachers, they were pupils in classrooms for various numbers of years. Teacher candidates bring with them sets of beliefs about teachers and teaching when they enter the teacher education programmes. According to Virginia Richardson (2003, p. 2), beliefs are important in teacher education because they have philosophical and psychological impact. She explained:

> First, beliefs, in large part, are thought of as the focus of change in teacher education programs, particularly within the more philosophical views. Second, pre-service teacher education candidates bring with them strong, and perhaps central beliefs about teaching into their teacher education programs.

These beliefs shape the training experience at teacher education programmes. Anderson went on further and cited Green (1971, p. 48) who claimed that:

> Teaching has to do, in part at least, with the formation of beliefs, and that means that it has to do, not simply with what we shall believe, but with how we shall believe it. Teaching is an activity which has to do, among other things, with the modification and formation of belief systems.

Tapping into these beliefs is crucial in the learning experience during teacher training. Anderson (2003, p. 15) noted:

> Beliefs are an important construct in education, and therefore in pre-service teacher education. When differentiated from knowledge in a philosophical sense, they are remarkably important since beliefs include what those using a more psychological approach often think of as knowledge. Changing, developing and refining beliefs are thought of as a primary goal of education; entering beliefs affect the ways in which teacher candidates approach the teacher education program and what they learn; and beliefs are also studied as anticipated or unanticipated outcomes of the educational process.

These assertions about teacher beliefs offer an understanding about the position of beliefs for teacher candidates and teacher educators. Teacher beliefs are instrumental in shaping the way teachers perform their duties in the classroom. Beliefs influence a teacher's disposition about knowledge acquisition, for himself and for others.

Past research has already established that beliefs play an important role in influencing teaching. According to Pajares (1992), "beliefs and belief systems serve as personal guides in helping individuals to define and understand the world and themselves" (p.307). Teacher beliefs are "an eclectic mix of rule of thumb, generalisations, opinions, values and expectations" (Lowyck, 1994, p.17) that become the fundamental principles that shape the way teachers plan, decide and act in the classroom (Nespor, 1987; Kagan, 1992; Pajares, 1992; Fang, 1996). These claims indicate the influence that teacher beliefs are able to exert on the way instruction is carried out in a classroom. Teachers bring their beliefs to a lesson even before the lesson is conducted. Their beliefs influence the way the instructional design of the lesson is created, the selection of objectives, selection of materials and media, and strategies to engage and assess student learning.

Numerous studies have supported the notion that teacher beliefs are interrelated with their use of technology (Higgins & Moseley, 2001; Wang, L. Ertmer, A., & Newby, J.T., 2004). Marcinkiewicz (1993) stressed that:

> … full integration of computers into the educational system is a distant goal unless there is reconciliation between teachers and computers. To understand how to achieve integration, we need to study teachers and what makes them use computers. (p. 234)

Tondeur, J., Valcke, M. and Van Braak, J. (2008), for instance, conducted a study with 574 elementary school teachers in Belgium. They investigated the relationship between teacher beliefs and their approach to computer use in the classroom. They found that teachers who held strong constructivist beliefs demonstrated a higher frequency in computer use. Their findings further affirm the influence of teacher beliefs on their use of technology.

A study by Antionetti and Giorgetti (2006) used a questionnaire survey on 272 teachers who worked in kindergarten, primary and secondary schools in Italy. They intended to investigate teacher beliefs regarding the use of multimedia, computer-supported tools in their schools. They found that the teachers' use of technology was mediated by their beliefs about its role in learning. The researchers concluded that the teachers shared similar opinions to those articulated in literature about computer use among teachers. The study illustrated what the teachers in the study thought about technology in terms of how it contributed to the learning process.

Understanding beliefs is crucial to understand how teachers perform their roles in the classroom. In the context of this research, the term "espoused theories" is used to refer to the concept of teacher beliefs. This is consistent with elements of the Reflective Learning Theory which was established by Argryis and Schön. Chapter 4 will discuss the notion of espoused theories in greater detail.

2.3 Summary

So far, findings, analyses and reflections from previous literature presented in this chapter have indicated that:

a. The impact of technology on the educational process (particularly computers in the classroom) is still unclear and there have been varying interpretations and expectations about the functions of technology in general for the teaching and learning process:

b. The focus of research in recent years has been on the technical application of ICT tools, rather than on the pedagogical aspects of using technology in relation to the subject matter discipline being taught:

c. The incongruence between keen interest to explore the use of ICT tools and the lack of pedagogical knowledge and skills to adapt technology effectively into the instructional delivery model is wrapped in a blinding faith and optimism about the purported potential of ICT to improve the value of education in the broadest sense;

d. The lack of understanding about the changing roles and challenges faced by teacher educators to meet changing (and evolving) demands for use of technology in classrooms; and

e. Teacher beliefs are a significant attribute in the process of teacher education. It is timely to look at issues related to the treatment of teacher beliefs in the context of training teachers to use technology in the classroom. However, there is limited research that investigates the impact of teacher beliefs about using technology within the process of teacher training.

These issues have directed this research to look into issues about teacher beliefs within teacher education programmes, specifically to understand how teachers interpret their training on integrating technology for classroom learning.

The following chapter extends the review on key studies on the treatment of pedagogy in Teacher Education, specifically in understanding how Technology is addressed in the synchrony with Pedagogy and Subject Matter Content (Mishra & Koehler, 2006). It will discuss issues regarding the epistemological position of teacher knowledge in relation to the way knowledge is categorised in the TPCK model by Mishra and Koehler. The chapter will also examine various interpretations of Constructivism, particularly in the teaching and learning of Educational Technology courses.

Chapter 3: Literature Review 2 - The Treatment of Pedagogy, Technology and Content in Building Teacher Knowledge

3.1 Introduction

The main goals of this chapter are to present analyses of relevant literature in these areas:

a) Pedagogical theories that relate to Educational Technology;

b) Interpretations of TPCK in building Teacher Knowledge.

This chapter focuses on current perspectives of the treatment of pedagogy, in light of technology integration into teaching and learning. It will discuss epistemological issues regarding the nature of knowing and knowledge. It will also expand on one of the fundamental aspects of this research – the Technological Pedagogical Content Knowledge (TPCK) framework, proposed by Mishra and Koehler.

3.2 Roles and Functions of Educational Technology and Pedagogy

In the broadest sense, Educational Technology plays a support role in a teaching and learning process. Educational Technology tools range from the most basic technology like chalk, to the most recent tools of the day, like ICT and web-based social networking tools. As a subject matter discipline, Educational Technology is often taught as part of a teacher training curriculum, a response to the increasing demands to use ICT in the classroom. An Educational Technology course within a teacher preparation programme normally would cover topics ranging from learning about the technical functions of ICT tools to using specific technology features to support the learning process.

Pedagogy is knowledge about the science of teaching (Shulman, 1986). In the context of this research, it is seen as a crucial act or process in any learning instance and environment. It provides a set of knowledge for instructors when teaching a set of knowledge and skills to a target learner group.

Over the past two decades, there have been numerous studies which focused on technology integration in the classroom, particularly in the scope of teacher readiness to design, develop and implement lessons. Many studies have questioned teachers' levels of competence in handling technology tools with curriculum content, in the effort to increase the quality of pupil's learning experience in their classrooms (Foti, 2005). Koszalka (2003) quoted data from the National Center for Education Statistics (NCES) in the United States, which indicated that in 2003, more than 99 percent of public schools in America have already been wired for technology use. However, the same agency reported that less than 32 percent of teachers regularly integrated educational technologies into their classroom practices. Koszalka's paper also revealed that availability and access to hardware did not appear to correlate with the actual use of technology for instructional purposes. Is this phenomenon caused by teachers' incompetence to handle technology hardware and applications? Have teachers been provided with sufficient training on using technology? These are some initial questions that have arisen from similar studies concerning the poor levels of technology infusion in classrooms around the world.

With technology increasingly becoming more accessible and affordable for the mass market, the shift of emphasis in many classrooms today has gradually focused more on the tools rather than on pedagogy. This is affirmed by McKenzie (2003), who runs a popular online bulletin for educators, *From Now On*, in which he wrote:

> For much of the past two decades we have mistakenly focused our energies on the learning of new software and the functions of new tools with too little attention to pedagogy - how to use those new tools effectively to maximize student learning while orchestrating all of the other aspects of daily classroom practice. (p. 1)

McKenzie argued that educators tended to treat lessons with computers with the same approach as attempting to "produce fast-food schooling" for their students; consequently, he observed, educators have become increasing dependant on the mechanical and routine nature of computing. Gradually students were fed with knowledge through the deployment of predetermined sequences of lessons on the computer, without much effort on the part of the teacher to closely align the suitability of learning content with the technology tools that were used in the classroom.

McKenzie's concern about the negligence in addressing pedagogical issues in correlation with the use of ICT in the classroom mirrors the issues investigated in this research. A selected number of research findings from previous studies will be presented in this chapter to assemble a general overview of how pedagogy is treated within the teaching and learning of Educational Technology.

Why is it important to consider pedagogy in using Educational Technology? Cox and Webb (2004) found that research studies have consistently shown that teachers' pedagogies have a large impact on students' attainment. Their findings uncovered a number of interesting concerns related to teachers' use (or, non-use) of technology that affects learning developments in the classroom. These include:

a) Teachers' decisions to take up the use of ICT in their teaching;

b) Teachers' knowledge about their own subject;

c) Teachers' knowledge of the potential for ICT to enhance their pupils' learning;

d) Teachers' ability to use ICT effectively (i.e. their ICT skills);

e) Teachers' knowledge about how to organise the learning before and after the lessons;

f) Teachers' ability to integrate ICT into their whole curriculum programme;

g) Teachers' understanding that ICT environments can promote new kinds of learning and new knowledge;

h) Teachers' ability to relate the ICT activity to learning goals and objectives; and

i) Teachers' ability to measure relevant learning outcomes.

Consistently, these concerns are centred on teachers' adaptation to the challenge to integrate technology into their individual and collective instructional systems. Though broken down into micro-teaching levels, the list by Cox and Webb above illustrates the importance of teacher knowledge in using technology tools. It is also anticipated that teacher knowledge should be demonstrated throughout the entire teaching process – from planning and creating lessons, to assessing students' level of achievement at the end of the teaching session. Thus, the teachers are expected to have sufficient teacher knowledge in dealing with technology integration so they will be able to become competent and effective in their use of appropriate technology tools.

Cox, M. J., Webb, M., Abbot, C., Blakeley, B., Beauchamp, T., & Rhodes, V. (2003) proposed the following competencies for teachers to be able to perform teaching using technology effectively. In their report, they proposed that teachers should (partial list):

a) understand the relationship between a range of ICT resources and the concepts, processes and skills in their subject;

b) use their subject expertise to select appropriate ICT resources which will help them meet the specific learning objectives; this includes subject-specific software as well as more generic resources;

c) be aware of the potential of ICT resources both in terms of their contribution to pupils' presentation skills, and their role in challenging pupils' thinking and extending their learning in a subject;

d) develop confidence in using a range of ICT resources, via frequent practice and use beyond one or two familiar applications;

e) appreciate that some uses of ICT will change the ways in which knowledge is represented, and the way the subject is presented to and engages pupils; and

f) know how to prepare and plan lessons where ICT is used in ways which will challenge pupils' understanding and promote greater thinking and reflection.

This report on teacher competency in handling technology in the classroom suggests a strong need for teachers to develop lessons that address the developments of higher order thinking skills through the use of technology tools. The list also emphasised the importance for teachers to be proficient and confident about their skills in handling technology tools. Subsequently it is envisioned that their technical competencies should enable them to focus on extending and expanding the learning processes of their students through effective use of technology.

In summary, several questions remain unresolved: if teachers are expected to have these competencies, acceptable levels of proficiency and confidence in using technology, what are the opportunities afforded for teachers to learn to teach using technology in their teacher preparation programmes? How are the Educational Technology courses in teacher education programmes designed to illustrate the needs of the school for a more technologically-savvy pedagogy? These are the questions that have led to the first research questions of this study - What conceptions do teacher educators and their students hold about teaching and learning with technology? Are these consistent with their teaching practices?

3.3 Notion of Teacher Knowledge

Teacher knowledge constitutes a conceptual body of wisdom that a teacher is presumed to acquire and posses, to guide him/her through his/her teaching practice. Larry Shulman, in 1986, delivered a seminal lecture at an annual American Educational Research Association (AERA) conference, in which he introduced a concept called Pedagogical Content Knowledge (PCK). PCK proposes the kinds of knowledge that teachers possess, that help them make effective and informed decisions and judgments about the subject matter taught and the pedagogical strategies used in the classroom. According to Shulman, PCK lies at the intersection of content and pedagogy, in the transformation of content into forms that are pedagogically powerful. Knowledge about the interrelationship between pedagogy, content and pedagogical content enables teachers to adapt their instructional design, content and delivery to match the learning needs and learner traits in each learning environment. Shulman stated that Pedagogical Content Knowledge (1986, p. 4):

> ...represents the blending of content and pedagogy into an understanding of how particular topics, problems, or issues are organized, represented, adapted and represented for instruction. Pedagogical content knowledge is the category most likely to distinguish the understanding of the content specialist from that of the pedagogue.

Figure 3.1 below illustrates PCK's position in Shulman's model, and its relationships with pedagogical knowledge and content knowledge.

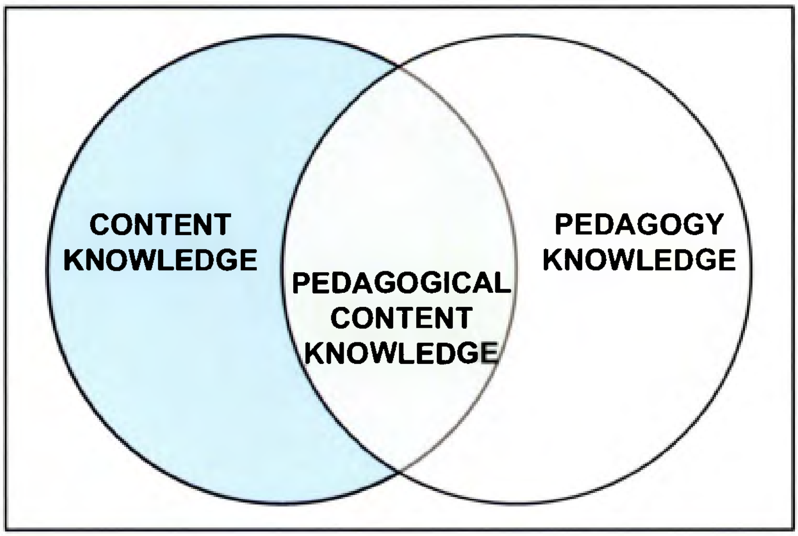

Figure 3.1: Shulman's Pedagogical Content Knowledge Model (1986)

In this model, Shulman stipulated that, when pedagogical and content knowledge are combined, the type of knowledge that emerged from the union of the two would present a significantly different type of knowledge, which he termed Pedagogical Content Knowledge. Shulman believed that Pedagogical Content Knowledge (PCK) should be addressed as a separate entity in building teacher cognition, as PCK represented the pedagogical orientations of any subject matter content to be taught in a given learning environment. Without adequate training in mastering PCK, Shulman believed that the teaching process would not have fully addressed both theoretical and practical understandings of the subject content knowledge taught.

According to Shulman (1986, 1987), PCK represents how content, pedagogy and knowledge about learners are combined and transformed into a representation of knowledge that is suited to meet the needs of the learners and match the scope and level of difficulty of the topic to be learned. Shulman's idea about teachers' knowledge bases specifically includes these categories of teacher knowledge:

a) Content knowledge;

b) General pedagogical knowledge;

c) Curriculum knowledge;

d) Pedagogical content knowledge;

e) Knowledge of learners and their characteristics;

f) Knowledge of educational contexts; and

g) Knowledge of educational needs, purpose and values, and their philosophical and historical grounds.

At the time of writing, another variation to the PCK framework has been introduced to Teacher Education literature. Taking a cue from previous debates on categorising subject-centric expertise and knowledge base for teaching as two separate but interdependent entities, Denis Berthiaume (2009) introduced the Model of Discipline-Specific Pedagogical Knowledge (DPK). He developed the DPK model based on his interpretations of arguments in previous literature about how academics conceptualise their thinking about teaching. He claimed that three components were important in influencing the conceptualisation process:

a) Teacher's knowledge about teaching;

b) Beliefs related to teaching; and

c) Goals related to teaching.

Berthiaume (2009, p. 216) understood from literature on disciplinary specificity that two types of characteristics shaped the way an instructor taught in a specific discipline:

a) Socio-cultural characteristics of the discipline (a socially constructed set of values which are built progressively through establishment of norms, practices or rules within a group of individuals); and

b) Epistemological structure of the discipline (the features of the discipline itself, based on how it was structured).

He further elaborated that these two characteristics were inadequate to represent the complex nature of pedagogical knowledge within a discipline-specific course. He offered another component to be considered, which he labelled as the teacher's personal epistemology. He defined it as "a teacher's personal beliefs about knowledge and its development" (Berthiaume, 2009, p.216).

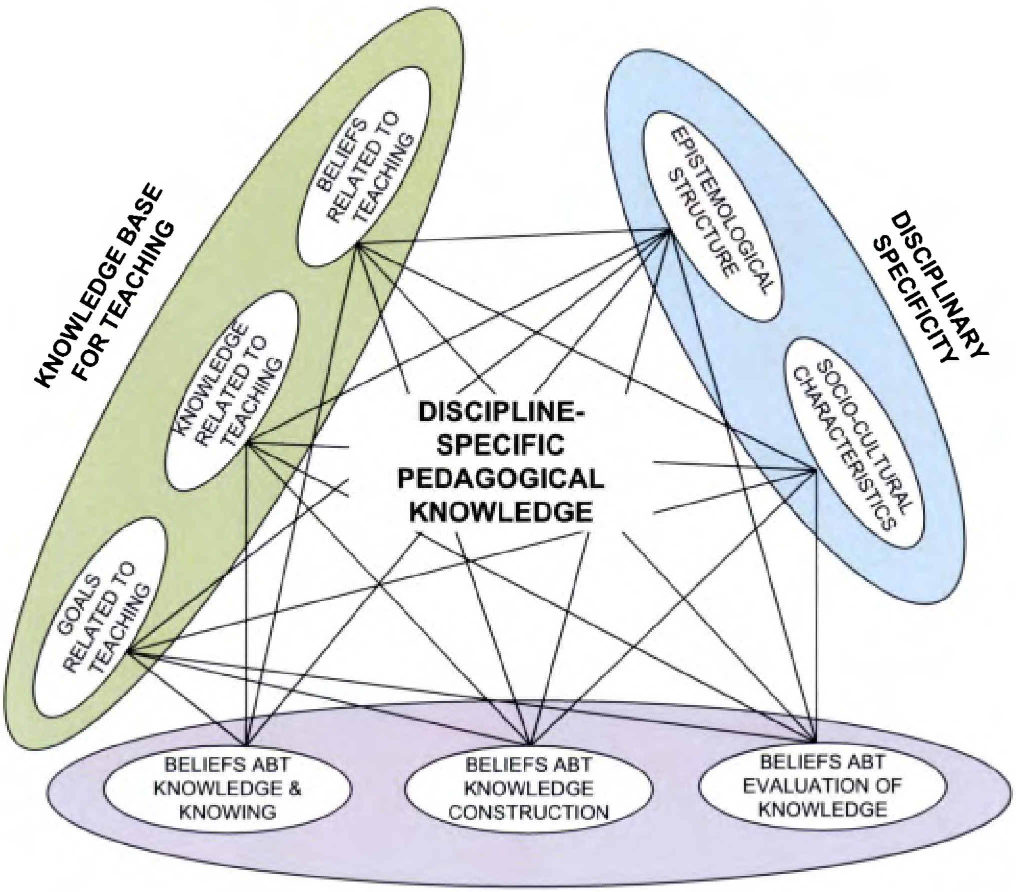

Figure 3.2: Model of Discipline-Specific Pedagogical Knowledge (DPK) for University Teaching, from Berthiaume (2009, p. 219)

Although this model is not considered in the research design for this study, it confirms the need to pursue research in this area of inquiry. At the time of writing, the research has already been conducted and analysed. This model was only published in early 2009. However, the notion of how teachers conceptualise and articulate their intentions through their teaching is the primary concern in this research. The introduction of the DPK model has further substantiated the need to examine teaching and learning in higher education. The classifications of components within the DPK model have provided additional support to previous research in this area of inquiry about the complex nature of knowledge building and sharing at tertiary level.

3.4 PCK versus PCKg

Since Shulman presented the PCK model two decades ago, there have been critiques of his idea to treat Pedagogical Content Knowledge as a knowledge entity separate from pedagogical knowledge and content knowledge. It has been argued that such compartmentalisation of knowledge types denotes an objectivist perspective about learning, in that it proposed that knowledge can be broken down into small chunks and transmitted to students.

Brownlee, J., Purdie, N. and Boulton-Lewis, G. (2003), for instance, offered their take on the concept of learning, which they claimed was derived from thoughts of Säljö (1979) and Marton, F., Dall'Alba, G., & Beaty, E. (1993). It related to the idea of knowledge building. According to Brownlee *et al.,* both Säljö and Marton *et al.,* described learning as "the acquisition of knowledge without any transformation of the information to develop understanding" (pp109-125). This is an important interpretation about knowledge as it acknowledges the connection between knowledge and the process of learning.

Among the strongest voices that criticised the PCK model came from those who viewed Knowledge in a more Constructivist approach to education. The learning process is seen as a contextually dependant activity, not an isolated entity. For instance, Segall, one of the more persuasive critics of PCK, claimed that when looking at Content Knowledge and Pedagogical Content Knowledge as two separate entities, the observation ignores the existence of teaching knowledge in the content itself (Segall, 2004). She stressed that pedagogy may not necessarily be seen as an external, separate or a per se entity, because in her opinion, each knowledge chunk was teachable, when positioned appropriately (the act of positioning knowledge, she added, was always already pedagogical).

In reflection, the epistemological position of knowledge can be interpreted in many ways. One example of such interpretation, which originated from a Constructivist view about knowledge, was one cited by Cochran, K., DeRuiter, J., & King, R. (1993) which was the work of Lerman (1989). Lerman had summarised the essence of Constructivism in the process of learning:

> Knowledge is actively created by the knower and not passively received in an unmodified from the environment; and the process of knowing and learning do not reveal an increasingly accurate, objective, or true understanding of an independent, pre-existing world outside the mind of the knower. (Lerman, 1989, p. 211, in Cochrane et al., 1993, p. 265)

This perspective is also similar to von Glaserfeld's interpretations about knowledge:

> Knowledge does not reflect an 'objective' ontological reality, but exclusively an ordering and organisation of a world constituted by our experience. (1984, p. 24)

Hashweh (2005) offered another variant to the Constructivist perspective on the notion of Pedagogical Content Knowledge. He believed it represented "a collection of teacher professional constructions, as a form of knowledge that preserves the planning and wisdom of practice that the teacher acquires when repeatedly teaching a certain topic" (p.277). His perspective was drawn from what he called "teacher pedagogical constructions", or the "knowing" part of "Knowledge." He further elaborated the assertions integrated into the definition.

a) PCK represents personal and private knowledge.

b) PCK is a collection of basic units called teacher pedagogical constructions.

c) Teacher pedagogical constructions result mainly from planning, but also from the interactive and post-active phases of teaching.

d) Pedagogical constructions result from an inventive process that is influenced by the interaction of knowledge and beliefs from different categories.

e) Pedagogical constructions constitute both a generalised event-based and a story-based kind of memory.

f) Pedagogical constructions are topic specific.

g) Pedagogical constructions are (or ideally should be) labelled in multiple interesting ways that connect them to other categories and subcategories of teacher knowledge and beliefs. (Hashweh, 2005, p. 277)

In his paper, Hashweh also insisted that PCK cannot be achieved solely through pre-service teacher education programmes, particularly the ones that are created based on conventional teacher training curriculum; he strongly believed that PCK is developed through experience, and without sufficient teaching experience, PCK will not be fully realised. This is a significant departure from the more objectivist approach used by Shulman to classify the idea of teacher knowledge. While Shulman is concerned with the segmenting types of knowledge into boxes of predetermined categories, Hashweh is more interested in the development process of acquiring knowledge, specifically the knowing process.

Similarly, Cochran *et al.* (1993, p. 266) expounded on the use of the term Pedagogical Content Knowing (PCKg), which they defined as "...teacher's integrated understanding of four components of pedagogy, subject matter content, student characteristics, and the environmental context of learning" (p.266). This pushes the boundaries of what knowledge entails, as utilised to explain PCK in Shulman's (1986) earlier work, in that it also considered elements of learning context, individual needs for learning, and related issues that affect the process of instructional delivery.

Cochrane *et al.* (1993) argued that "the term 'knowledge' [is] too static and inconsistent with the constructivist perspective." They cited von Glaserfeld (1991) who advocated the theory of Radical Constructivism, which he defined as:

> ... a theory of knowing which furthermore, clearly distinguishes training from teaching. The former may lead to the replication of a behavioural response; the latter aims at generating autonomous conceptual understanding. (pp. xv, xix)

The PCKg model offered by Cochran *et al.* (1993) was built on the premise that knowledge acquisition is a continual process and that they believed "increasingly strong PCKg enables teachers to use their understandings to create teaching strategies for teaching specific content in a discipline in a way that enables specific students to construct useful understandings in a given context" (p 264). They further elaborated that teachers should develop their pedagogical knowledge and content knowledge in tandem with their knowledge about students' understanding and knowledge about the learning environment. They acknowledged that Shulman identified these concepts in his PCK model too, but they insisted that they placed more weight on the two additional components of PCKg.

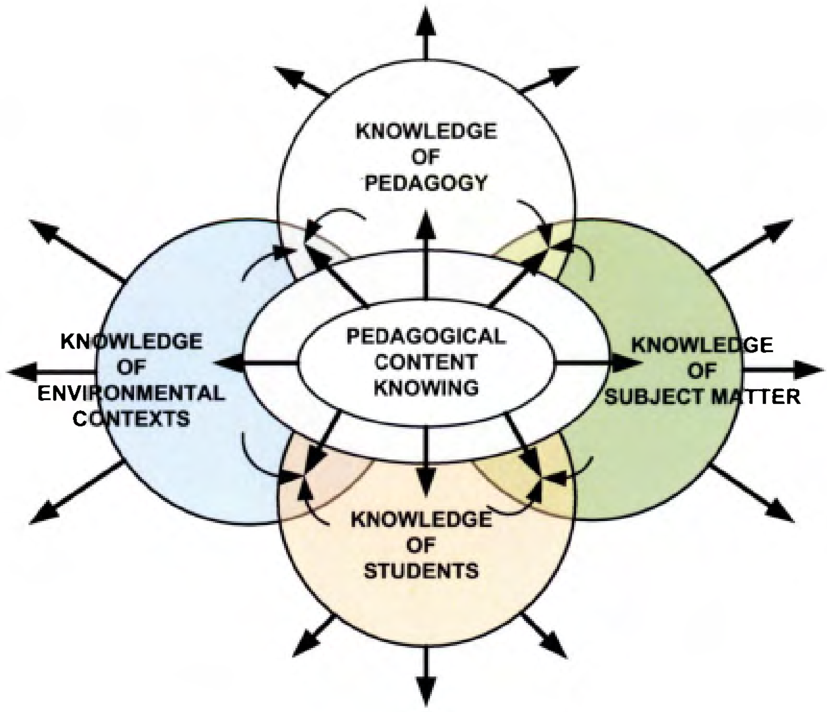

Figure 3.3: A Developmental Model of Pedagogical Content Knowing (PCKg) as a Framework for Teacher Preparation, from Cochrane *et al.* (1993)

Figure 3.3 illustrates the four components that contribute and interact with each other to form Pedagogical Content Knowing. Cochrane *et al.* (1993, p. 268) insisted that each component is a unique entity and all four components could be "unevenly developed or integrated as pre-service teachers negotiate the preparation process."

In retrospect, whether or not the PCK model ignores the existence of teaching knowledge in the content itself, as argued by Segall, Hashweh, Cochran and others, the Shulman PCK model has opened the dialogue and debate, about the treatment of pedagogy in the teaching of content more closely. It is responsible for the emergence of new perspectives to scrutinise the value and relationships of each element of teaching knowledge as engaged by teachers during a teaching process. The PCK model has enabled dialogue about each teacher knowledge type to be categorically assigned to a particular classification, which consequently allowed opportunities to understand how each teacher knowledge type reacts and responds to each other within a teaching instance.

There also exist claims that "inexperienced teachers have incomplete and superficial levels of PCK" (Carpenter, Fennema, Petersen & Carey, 1988; Feiman-Nemser & Parker, 1990; Gudmundsdottir & Shulman, 1987; Shulman, 1987). This is one of the concerns in this research and this issue will be explored further in the Methodology chapter.

Central to the PCK model is teacher cognition, and it is not a surprise that criticisms would arise about its focus on teacher-centred pedagogy, rather than a learner-centred pedagogy (Banks, Leach & Moon, 1999). Before being able to focus on learner-centred learning, a teacher has to have his or her own conceptions and competencies about pedagogy in general. The PCK model has enabled teachers to articulate and examine their pedagogical approaches closely, by eliminating knowledge that is contributed by the subject matter that they are teaching. The classifications of knowledge as proposed by the PCK model allow teachers to view their individual pedagogical beliefs and practices, so they to enable them to detect any flaws or gaps in the way they approach their learners with their personal pedagogical philosophies and instructional practices in the classroom.

Despite the arguments put forward in the critiques, in the context of this research, the PCK model is deemed useful as an analytical tool. Although there are epistemological concerns about the conceptual approach employed by Shulman to explain his model within the context of teaching and learning, the PCK model is functional in visualising the relationships between teacher knowledge components. It may not serve to distinctly analyse every possible teaching and learning pathway or process that teachers undergo while their teacher knowledge is being developed, but for the purpose of this thesis, it is a tool to develop a research design to analyse narratives and the existence of evidence of practice, particularly at a preliminary analysis level.

3.4.1 How PCK became TPCK

There is a growing awareness among educationists of the increasing need to adjust and adapt pedagogical beliefs and approaches to match current advancements in technology tools with classroom goals and learning content. There have been a number of scholars, mostly from America, who have attempted to use the PCK model to theorise conceptual frameworks to explain how the teaching of Educational

Technology could be explored efficiently. There have been variations of attempts; one was by Margerum-Lays and Marx (2003) who used the term PCK for Educational Technology; Slough and Connell (2006) who used the term Technological Content Knowledge; and Mishra and Koehler (2006) who proposed the term Technological Pedagogical Content Knowledge. More recently, Angeli and Valanides (2009) have offered the term ICT-TPCK to denote the use of TPCK exclusively for the applications of ICT. All these variations suggest a similar concern about the need for interconnections between content, pedagogy and technology knowledge.

Punya Mishra and Matthew Koehler (2006) introduced a Technology component element to Shulman's original PCK model, in light of the growing interest in creating "new integrated pedagogies" for teaching with technology.

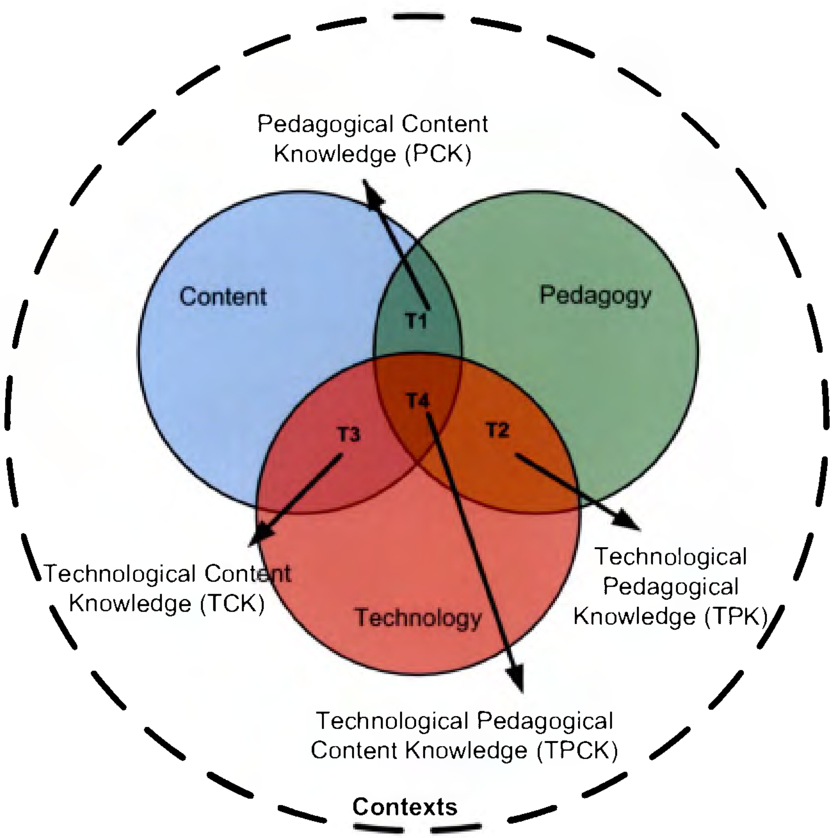

Figure 3.4: TPCK Framework and its Knowledge Components, by Mishra and Koehler (2006) and Harris, Mishra and Koehler (2009)

The TPCK framework represents how technology influences teacher knowledge. It suggests that teachers will need to acquire sufficient and appropriate technological PCK in order to deliver instruction effectively in the classroom.

The technology component was added to the original dyad PCK model, and subsequently the new adapted TPCK model pushes the understanding about teacher cognition to a new level. With technology being part of the pedagogical and content knowledge elements, the understanding about teacher cognition evolves further to embrace the more technical elements. The newly added technology component adds four new sections to the original Shulman framework:

a) Technological knowledge;

b) Pedagogical technological knowledge;

c) Technological content knowledge; and

d) Pedagogical technological content knowledge.

The TPCK model proposes that a coherent and cohesive treatment to all three key domains of knowledge is essential in the development of teacher cognition. The TPCK model enables an interpretation of teacher learning in a more complex, but systematic, perspective. More significantly, it highlights the growing need for teachers to acquire in-depth understanding of each domain, to remain relevant and effective in his/her teaching role.

According to Mishra and Koehler (2006):

> Quality teaching requires developing a nuanced understanding of the complex relationships between technology, content and pedagogy, and utilizing this understanding to develop appropriate, context specific strategies and representations. Productive technology integration in teaching needs to consider all three issues not in isolation, but rather in the complex relationships in the system defined by the three key elements. Thus, our model emphasizes the complex interplay, connections, and interactions, between these three bodies of knowledge, without privileging any of them specifically.(p. 1)

The TPCK model is an important step forward in understanding the development of teacher cognition in teacher education programmes, particularly in the integration of technology into education.

Mirroring the epistemological concerns from the PCK model, the TPCK model also superficially implies the partitioning of each field in the model, and thus subsequently it does not completely acknowledge the interplay of all fields together as one unit of knowledge.

> At the heart of TPCK is the dynamic, transactional relationship between content, pedagogy, and technology. Good teaching with technology requires understanding the mutually reinforcing relationships between all three elements taken together to develop appropriate, context-specific, strategies and representations. (Koehler, M. J., Mishra, P., & Yahya, K. ,2007, p. 741)

However, the TPCK model represents an important step forward to understand how teaching and learning of educational technology is translated from theory into practice. The TPCK model does not fragment or externalise knowledge, but rather it provides a way to frame personal conceptions and practice, and it can be used both to analyse and to prompt reflection. The TPCK model provides a way to represent, and not redefine, development of knowledge. This is a new and challenging tool to understand how teachers interpret their personal pedagogies.

3.4.2 Understanding the TPCK Model

This section focuses on the knowledge types presented in the TPCK model. It is important to analyse the elements of TPCK in relation to current teacher education issues, to understand the effectiveness of this model as a tool to enhance the quality of teaching with technology.

In contextualising the challenges perceived by teacher educators, Mishra, Koehler and Zhao (2006) listed several common sources of problems:

a) lack of experience in teaching/learning with technology;

b) rapid rate of technology change;

c) inappropriate design of software;

d) situativity of learning;

e) emphasis on 'what' not 'how;'

f) time intensive nature of technology integration; and

g) the 'SEP' syndrome (someone else's problem).

The list hints at a deeper concern about how the role of technology is perceived in teaching and learning. The impact that each teacher educator's instructional approach has on the learning process depends on the effectiveness and competencies of the educator in his/her use, or non-use, of appropriate content, pedagogy, and technology in the instructional design and delivery processes.

According to Resnick (2002), the perception that knowledge is transmitted to learners made it easy for any lay person to assure there is an advantageous role for a computer in the classroom, as it could replace the transmission role of the teacher in the learning environment. Resnick argues that, "to take full advantage of new technology, we need to fundamentally rethink our approaches to learning and education and our ideas of how new technology can support them" (p. 32). A similar insight by Leach and Moon (2000) offered an argument about how various studies that have evaluated the impact of applications of new technology on education found that the effects have been 'consistently disappointing.' This is a profound concern that must be considered before any teacher decides to use any type of technology in the classroom. Without properly understanding the role and functions of technology, the instructional delivery will merely be a transmission of a packaged knowledge set through use of costly media. In sum, if these opinions about teacher knowledge on technology are mapped onto the TPCK model, the gaps pointed out by Resnick, Leach and Moon (discussed above) can be represented as missing these categories in the model:

a) Technological Content Knowledge (T1);

b) Technological Pedagogical Knowledge (T2); and

c) Technological Pedagogical Content Knowledge (T3).

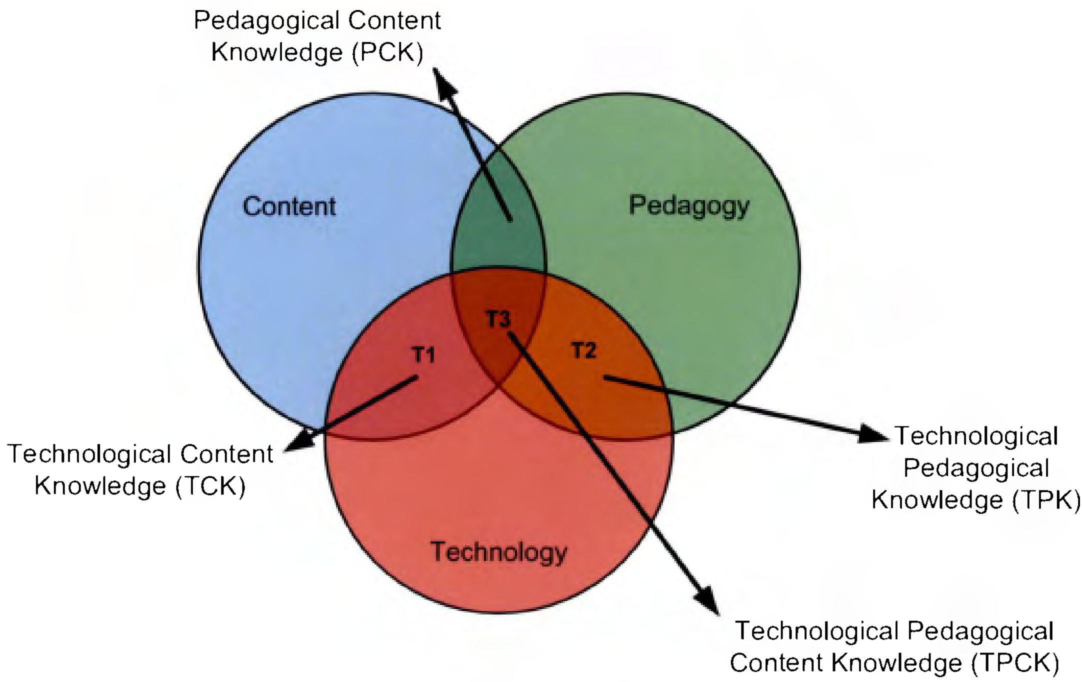

Figure 3.5: TPCK Framework with Emphasis on New Types of Teacher Knowledge

There had been a notable number of arguments triggered by the Shulman's PCK model. Academics questioned the objectivist-biased strategy to compartmentalise teacher knowledge into the seven categories introduced by Shulman (1996). Similarly, in the TPCK model, the same arguments could be further expounded because this framework also emphasised the teacher's competency to create, and direct, learning opportunities in the classroom. Teacher knowledge is also categorised and labelled into distinct spaces within the framework. Though the TPCK model does place new, and much needed, emphasis on the technology aspect of pedagogical knowledge, it also assigns additional emphasis on increased expectations for teachers to be technically ready to handle their increasingly technology-savvy lessons. When technology (particularly ICT) was introduced to classrooms worldwide, the focus of learning was mainly on technical knowledge and skills of technology, rather than on the integration of technology tools into actual learning content. Now, with the TPCK model, it is made clear how the technical knowledge and skills in ICT are just one part of a bigger issue – teachers have to address the building of their competencies in integrating technology.

In sum, the categorisation of knowledge types in the TPCK model opened an interesting approach to illustrate the neglected parts of developing teacher knowledge in parallel with using technology; by explicitly drawing out the different components that have to be combined and complemented by one another, the model enables an identification of where common areas of teacher cognition are often sidelined or neglected in teacher education programmes. The TPCK model provides an opportunity to reflect on discrete types of knowledge, and it signals the areas in need of review and revamping, in order to build teacher competencies effectively in any teacher preparation programme. The TPCK model is useful as it is able to reveal numerous overestimated and under-assumed areas in teacher cognition. Using the TPCK model will be central to this research, as it will provide the primary tool to describe the building of teacher knowledge. This thesis aims to provide a useful contribution to understanding about development of teacher knowledge, by investigating how it is dealt with in selected teacher education programmes in Malaysia.

3.5 Summary

This chapter has provided an insight into how teacher knowledge is understood and developed. It reviewed previous studies that looked at how technology has influenced the way teacher knowledge is perceived and built in teacher education programmes. Findings from various studies in teacher knowledge and teacher education have revealed how pedagogical and content knowledge aspects of teaching are oftentimes neglected in lessons that use technology. These debates and evidence of research have motivated the research design of this study. Although the field of teacher education is immense, this research will focus only one aspect of teacher cognition. It will focus on the way teacher knowledge is interpreted by teacher educators and student teachers who are currently involved in the teaching and learning of Educational Technology courses in selected teacher education programmes.

The following chapter takes its cue from discussions in this chapter to further expound on the relationships and interactions between the building of Teacher Knowledge, Reflective Learning and Constructivism.

Chapter 4: Literature Review 3 – Reflective Learning and its Relationship with Teacher Knowledge and Constructivism

4.1 Introduction

The chapter examines Reflective Learning theory to investigate its suitability as a theory to interpret beliefs as well as evidence of practices of teacher educators and their student teachers. This chapter looks at how Constructivism is dealt with in the process of teaching and learning. Consequently, reviews of both key concepts are used to shape a crucial part of the research. It informs the research design process to explain how the theories are translated into action.

In this chapter, the genres of literature used are both academic and non-academic. The non-academic literature originates from personal accounts of teachers and educators and they are used alongside the literature from conventional academic sources. It is deemed necessary to include non-academic resources in this review because they represent a more candid, personal and forthright voice to the body of literature reviewed for this study. The choice for a mixed genre is to synchronise the goals of this research as a whole; the intention is to capture perceptions and beliefs about using technology in a training scenario. The use of personal and professional resources provides leverage in considering how perceptions and beliefs are documented in personal and professional platforms of publication available today.

4.2 Reflective Learning Theory

The age-old debate about translating theory into practice has been the crux of numerous research studies in the teacher education field for many decades (Howey, 1987; Steiner, 1996; Mitchell, 1997; Tabulawa, 1998; Korhagen, 1999; Putnam and Borko, 2000; Segall, 2001). Among the many models used to describe how theory is translated into practice, Reflective Theory is highly regarded for its efficacy.

In Reflective Theory which was made popular by Chris Argyris and Donald Schön (1992), the terms "theories-of-action", "espoused theories" and "theories-in-use" were introduced. Their theory came about as a strategy to understand issues of management principles and practices and it has proved useful to compartmentalise issues and subsequently critically analyse each aspect of an issue. Oftentimes some aspects of an issue are misinterpreted, ignored or even discarded as insignificant. Through Reflective Theory, Argyris and Schön were able to articulate specific elements used in principle and practice that directly affect actual actions. The theory has contributed a replicable approach to understanding how human beings conceptualise beliefs, philosophies and principles about an idea, issue or behaviour, and the theory creates a strategy to consistently trace how such conceptions are translated into a behaviour or action.

According to Argyris and Schön (1992), theories of action graphically represent the mechanisms and dynamics used to link thoughts with action. Theories of action are divided into two types:

1. Espoused theories – these represent what we know about, or what we espouse regarding ourselves (individually and in a group); and

2. Theories-in-use – these represent the actions that we project to the external world based on what we know or what we espouse. Most of the time, these values are not obvious to the individual.

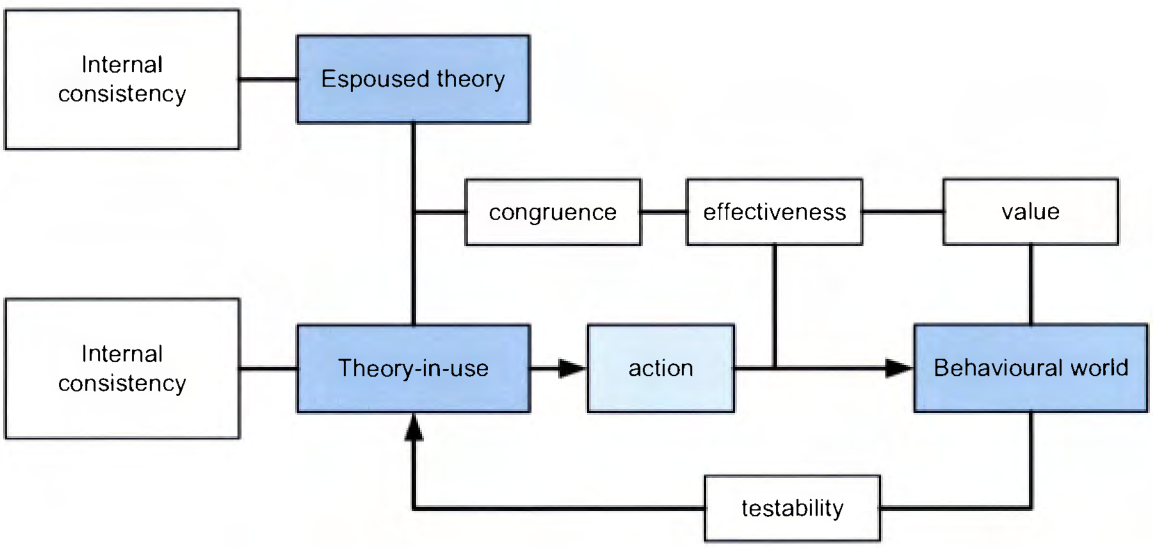

Figure 4.1: Components of Theories of Action, as presented by Argyris and Schön (1992)

Figure 4.1 illustrates how espoused theories and theories of action (an integration of theory-in-use and action) interact with each other. The overarching idea is to enable the analysis of internal consistencies between a person's and a group's espoused theories and their theories of action. **Figure 4.1** shows how different variables affect and influence an espoused theory. Consequently, it is performed as a theory-in-use. Elements such as congruence and effectiveness affect the way an espoused theory is translated into action. The element of value is closely linked to conceptions in the Behavioral World. This means that, when an espoused theory is translated into action, it is also governed by the context in which the action would take place (such as culture and language). This illustrates an important idea about how humans perform what they believe; their surroundings determine how their belief is shown to others. Another important element in the analysis is testability; a theory in action may not be effectively analysed without sufficient testability tools or protocols that can be used to gauge the effectiveness of the whole transaction process.

Oftentimes it is deemed difficult to gauge because Espoused Theories (or Theories-of-Action) are personal to the individual. According to Schön (1987), problems commonly occur in a professional activity "due to the misunderstanding of theory and practice" (in Moon, 2001, p. 128). Schön believes that "there is a tendency to assume that the formal theory of a professional subject area prescribes the form of practice" but he insists that it is the manner in which professions have developed and their pattern of beliefs that determines the functioning of the practitioners (Moon, 2001, p. 128). When a person is confronted by another person's differing perspective, it is common that the person would react in a confrontational and defensive manner, because the perspective offered by the other person would not immediately be obvious. Theory-in-action, on the other hand, covers the interpretation of an act/behaviour from the perspective of someone external to the person acting out the act/behaviour. It represents the actual act of translating the preconceived espoused theories into an observable action.

In the context of this research, it will be a challenge to document a participant's espoused theories and his/her theories-in-action. Based on the components advocated by the Reflective Learning theory, it is selected as a tool for this research because it essentially provides systematic representation to articulate the similarities and gaps between participants' beliefs and actions.

In this research, the Reflective Theory will be used in two formats. Firstly, it will capture the espoused theories and theories-in-action in relation to how teacher knowledge is developed within teacher education. Secondly, it will measure how Constructivism is espoused and put into action by teacher educators and their student teachers as they teach and learn Educational Technology.

At the point of writing, there has not been any known research that has attempted to use Reflective Learning theory in parallel with the TPCK framework and Constructivism, as proposed in the methodological design of this research.

Further explanation about how Reflective Learning theory is used in this research will be presented in the Methodology chapter.

4.3 Constructivism in Teacher Education

In the context of this research, it has been deemed necessary to include an analysis of how Constructivism as a learning theory has influenced the way ICT has been used for learning, particularly in the training of teachers for their professional uses of technology in the classroom. In the following sections of this chapter, the review of literature focuses on the presence of Constructivist principles in the use of technology in the classroom.

4.3.1 Constructivism and the Teaching with Technology

Of late, Constructivism has gained popularity among educators, as its principles advocate active involvement between the learner and the learning tool that he/she uses, in the process of acquiring knowledge and skills. In many studies, it has been established that meaning-making is central in the learning process. When ICT tools were introduced to classrooms, features such as hypertext and text editor tools were seen as a representation of Constructivist elements in action because they allow students and teachers to create and construct their own meanings, individually or in groups, of any learning object featured in a lesson. The section will start with general definitions and current perceptions about the position of Constructivism in education, and subsequently will explore how Constructivism has affected educators when teaching and learning with technology.

As a theory and an epistemology, Constructivism has been presented through many definitions and perspectives. Constructivism, according to Knuth and Cunningham (cited in Duffy, Lowyck and Jonassen, 1993), has affected the field of instructional design and development in the last few years. Though there is no one single definition of Constructivism (Perkins, 1992; von Glasersfeld, 1992), it is essentially categorised as a theory of learning, and not a theory of teaching (Wolffe & McMullen, 1996). Constructivism assumes that "learners construct knowledge by interpreting our perceptual experiences in terms of our prior knowledge, current mental structures and existing beliefs" Jonassen, D., Mayes, T., & McAleese, R., 1998,, p. 233).

There have been different interpretations in the academic circles about the nature of Constructivist learning; some radical (such as Radical Constructivism), others more pragmatic (such as mindtools). The radical Constructivists value the meaning-making process as being a truly individualistic process, in that standardised testing and grades should be abolished, to give way for assessment based on the teacher's and the student's realities. The pragmatic perspective on Constructivism looks at learning as a socially constructed process, where meaning-making is achieved through dialogue and negotiation in a community of practice.

Constructivism could be traced back to writings by Dewey (1966), Bruner (1962, 1966), Vygotsky (1978) and Piaget (1970). Historically, it has its roots in philosophy, in that evidence of Constructivist notions in learning could be traced in the works of Plato, Socrates, Aristotle, and Locke (Yager, 1991). Null (2004) presented an insightful analysis on historical thoughts by Rousseau, Pestalozzi and Hall, who spoke about the idea of allowing children to construct their own learning experiences through their individual and natural learning environment. These ideas, introduced more than two centuries ago, are resonant with the ideas and philosophies that underlie the concept of Constructivism today. The educationists in the past had found it difficult to apply Constructivism in actual learning settings, and the same problems are recurring in classrooms of today, where school teachers are attempting to integrate Constructivist elements into their instructional delivery.

Similarly Piaget (1970) defined Constructivism as being based on the conception of a child as a little scientist, who actively explores the world, collects data, makes and tests hypotheses, makes principles from his findings, and tries to make sense of his learning based on his involved experiences. Knowledge is seen to be constructed through the active mental processing of perceptions. Through this generative processing, the learners reach personal levels of understanding about the learning contents. In Constructivism, meaning-making is the key to learning; the deeper levels of processing are required or anticipated in the process of extracting meaning. This is succinctly described by Perkins (1992):

> Central to the vision of Constructivism is the notion of the organism as 'active' - not just responding to stimuli, as in the behaviourist rubric, but engaging, grappling, and seeking to make sense of things. (p. 49)

It is established that Constructivism looks at learning as a constructive meaning-making activity, in which learners build their understanding and knowledge, based on what they have already known, learned or experienced, with elements that they come into contact with (Cannella & Reiff, 1994; Richardson, 1997). On the other hand, Objectivism looks at knowledge as an external entity, with an absolute value, that can be passed on from the teacher to the student (Duffy & Jonassen, 1992; CTGV, 1993). Objectivism has influenced the approaches taken by educators and designers of instructional materials, in that students are assumed to take up a relatively passive role in the learning process. Objectivist teaching provides structure to the learning experience, while in Constructivist teaching learners create their own learning paths with the teacher's facilitation. Rovai (2004) articulated his perspective of the pedagogical shifts in Higher Educational Institutions' (HEI) learning environments, in a graphic example presented in **Figure 4.2** below.

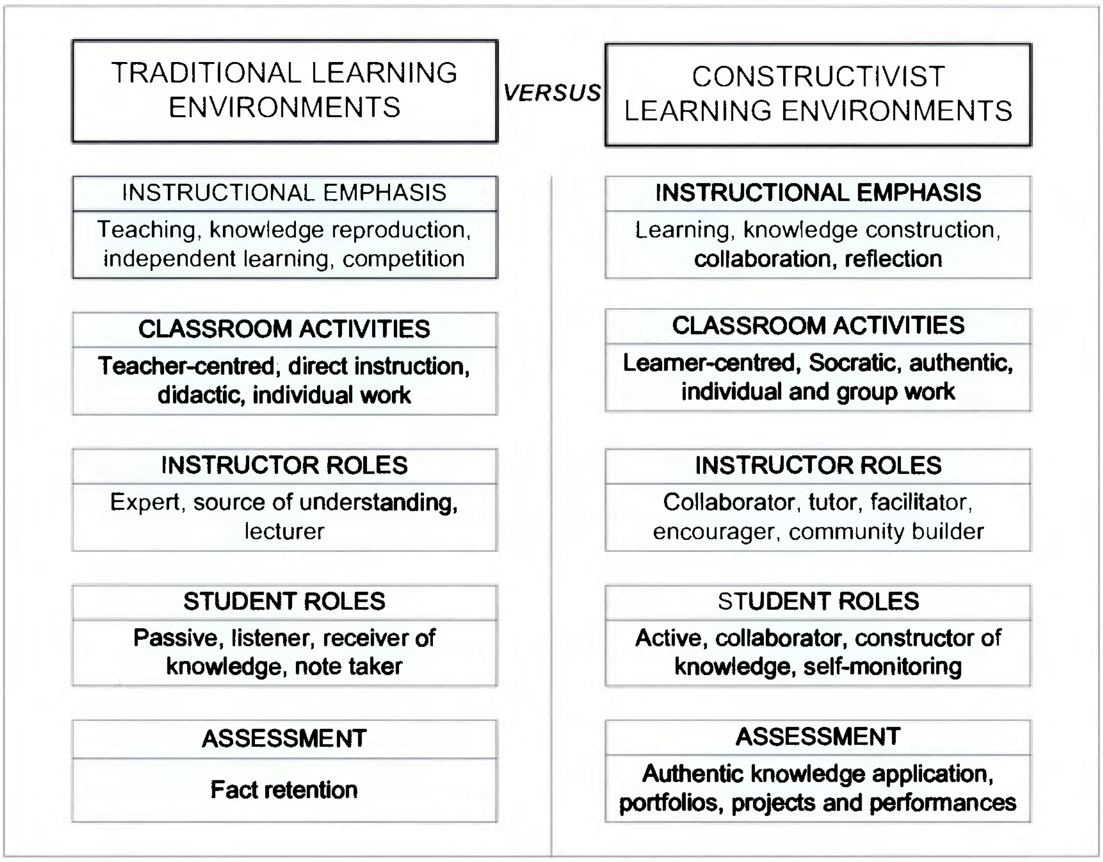

Figure 4.2: Elements of Emphasis in Higher Education (Traditional versus Constructivist Learning Environments), by Rovai (2004)

Rovai's list succinctly presents the effects of both traditional and Constructivist learning environments on every key component of teaching and learning. It is clear that the two sets of pedagogical emphasis affect HEI teachers' roles, from being sole providers of learning opportunities, and to a guide-on-the-side role of facilitating the building of knowledge for comprehension. Consequently, if Constructivism is adopted to replace the more traditional approach to teaching, the nature of classroom learning becomes more flexible, less tangible, and more context-dependant.

According to Dalgarno (2001), there are three widely perceived principles that define the Constructivist view of learning. The first principle centres on the idea that "each individual forms their own representation of knowledge" (p. 183). This idea was initially introduced by Kant (1798) and was further developed by Dewey (1966), and more recently, von Glaserfeld (1984). This first principle upholds the notion that *each individual creates unique interpretations of their own realities and experiences*. The second principle focuses on the idea that *individuals learn through active exploration*.

The idea is primarily attributed to Piaget. Based on the second principle, the uniqueness of each individual's knowledge explorations result in the inconsistencies between their current knowledge representation and their active learning experiences (McInerney & McInerney, 1994). The third and final principle talks about the *social aspect of the learning process, in that interaction between individuals in a learning environment becomes a pivotal part of the learning process*. This principle is largely attributed to Vygotsky, who strongly believed that learning is a powerful social activity. For the purpose of this research, these three key principles will be utilised in the research methods design, to capture interpretations of Constructivism as perceived and practiced by teacher educators and student teachers who will be involved in this research. The three principles provide ample opportunity to gauge espoused theories and theories-of-action that exist in the target sample group, and the principles cover a sufficient range of Constructivist application, from the perspective of the individual self to his or her community of practice. In the scope of this research, the range covered by the three principles will be adequate to understand the relationship and impact of using Constructivism in the teaching and learning of Educational Technology in the selected teacher education programmes, from the view of the teacher educators and their respective student teacher community.

When using technology in the classroom, pedagogically, teachers have tended to lean toward a more Constructivist approach in teaching (Crawford, 1999). The Constructivist approach is seen to embody the elements necessary for students to develop higher order thinking skills when using technology tools effectively in their learning process. In recent times, it has gradually been used because it was seen to encompass the "grand unified theory", an expansion from merely a learning theory, to "becoming a theory of teaching, a theory of education, a theory of the origin of ideas, and the theory of both personal and scientific knowledge," as observed by Matthews (2000, p.161). Due to the large volume of essays, arguments and positions that have been presented and debated to define the principles of Constructivism over the years, in cognitive, sociological and psychological circles of academia, it would be too ambitious for this research to include all documented perspectives, definitions and approaches.

For the purpose of this research, only resources that looked at the treatment of Constructivism in the context of teacher education will be utilised, because they contribute directly to the scope of this study.

A few studies have highlighted the use of Constructivist principles in the classroom, especially when using technology tools in the teaching and learning processes, often as a signal of notable change in pedagogical approach due to use of ICT in instructional delivery.

One example of such studies can be seen in a two-year project carried out by Beyerbach, B., Walsh, C., & Vannata, R. (2001). Their study explained how decisions made by the US Department of Education in the recent years in terms of adopting Constructivism in teaching with technology have led to a growing interest in reanalysing the way teacher education programmes were handled, in terms of providing opportunities for student teachers to learn through the principles of Constructivist teaching using appropriate technology tools. They also found that, after going through a contextualised study programme that involved the student teachers and their course instructors (teacher educators) in using technology in their instructional process, both groups illustrated changes in their perceptions about the role that technology played in an instructional process. Their views shifted from believing they had to master technical knowledge of technology to an insight that they need to find strategies to use technology to enhance the learning process.

To understand Beyerbach's study in the context of this research, their findings are analysed using the TPCK model. The objective is to illustrate any similarities or gaps in the way teacher knowledge which was analysed in Beyerbach's study. Based on the mapping, it is found that there is a strong emphasis in practice on Technology Knowledge and Technological Content Knowledge. The mapping also presented gaps in two knowledge components:

a) Technological Pedagogical Knowledge (TPK); and

b) Technological Pedagogical Content Knowledge (TPCK).

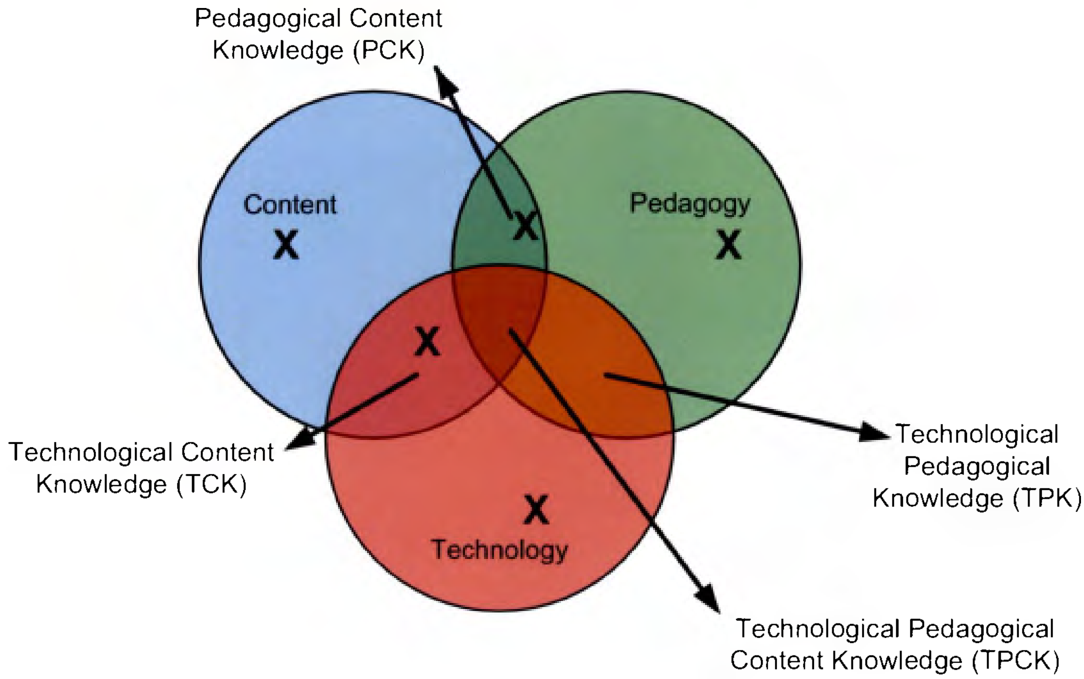

Figure 4.3: Mapping of Beyerbach Study on TPCK Framework

Figure 4.3 shows the mapping of teacher knowledge types which were present and missing from the teacher training programme observed in the Beyerbach study. The mapping presented gaps between pedagogy and technology and an integration of the two knowledge types with subject matter content.

The analysis done using the mapping technique may be an important step in the current teacher education research. It presents a visualisation to help understand how teacher knowledge could exist or be missed in a teacher education course. In the case of the Beyerbach study, although the study discussed the use of Constructivist learning (which highly recommends active meaning-making in the instructional process) in its infusion of technology in classroom instruction, the mapping showed evidence of gaps that exist in the way pedagogical knowledge (in this case, Constructivism) is integrated into instructional delivery.

For a teacher who uses ICT in the classroom, the approach to teaching generally shifts to guiding students to build and modify their existing mental models, a focus on knowledge construction rather than knowledge transmission (McInerney & McInerney, 1994; Slavin, 1994). An example that illustrates this is in a related study by McLoughlin and Luca (2000), who looked at the use of asynchronous communication in a computer-conferencing learning environment. They analysed the importance of "tasks, activities and interventions" managed by the course instructor in the online discussion forum, and their impact on the building of higher order thinking skills among the students in the course. They found that, to make the online interactions effective for building higher order thinking skills, the learning environment should be staged with cognitively challenging tasks and activities, that would enable students to engage in higher level interactions that test their pre-existing assumptions and ideas. In sum, on the path to develop higher order thinking skills, teachers now are challenged to adapt new ways to teaching. Teacher might have to adapt to a more Constructivist approach in their teaching approach to accommodate learning opportunities that facilitate the acquisition, assimilation, accommodation and reflection of content and skills presented in their ICT-based learning environments.

If higher-order thinking skills are expected from students in schools and universities in the current education context, teaching methodologies which prescribe objectivist goals will have to be adapted to create learning opportunities that allow for critical, creative and complex thinking developments. Zahorik (1995) suggests the use of Constructivist theory as a basis for teaching methodology to support the development of higher order thinking skills:

> Knowledge is constructed by humans. Knowledge is not a set of facts, concepts or laws waiting to be discovered. It is not something existing independently of a knower. Humans create or construct knowledge as they attempt to bring meaning to their experience. Everything we know, we have made... Knowledge is conjectural and fallible. Since knowledge is a construction of humans and humans are constantly undergoing new experiences. Knowledge can never be stable. The understandings that we invent are always tentative and incomplete... Knowledge grows through experience. Understanding becomes deeper and stronger if one tests it against new encounters... (pp. 11-12).

The description signals an important departure from the more conventional objectivist approach in teaching. Constructivism accepts that the student takes ownership of his or her own learning process. A teacher using a Constructivist approach in the classroom will have to re-learn his role, because he cannot reprise his conventionally accepted role as the sole point of authority in the class. Using Constructivist principles, teachers scaffold their instruction to help students engage in meaning-making tasks and activities, and the learning environment needs to be designed to continuously facilitate the process of active learning.

How does technology become a tool for learning, and in the case of this research, a tool for Constructivist learning? According to Jonassen *et al.* (1998), there are two types of tools that could help Constructivist learning environments: tools to support active learning, and tools for observational learning. When dealing with cognitive learning, learners will require tools that can enhance their mental operations to "acquire, construct, retain and retrieve different kinds of knowledge or performance" (p.165). As a tool for active learning, technology could push learners to generate meaning through information representation, where learners will activate and apply cognitive learning strategies to existing schemata, to re-interpret or re-synthesize their personal understanding. The idea is to increase the number of links between information structures, so the learners are able engage in deeper levels of cognitive processing. These processes could be made available and transparent, and hopefully more efficient, using technology tools. Besides activating learning, learners can also acquire knowledge through observations. Technology tools could provide a medium for learners to learn from others. When learners are given the opportunity to engage in other people's learning events, their learning experience can be enriched by their own needs and hypothesis which are generated through personal learning developments. For student teachers who are undergoing their teacher preparation programmes, for instance, they could view and observe video clips and simulations of classroom instances. The learners could draw upon the experiences they view from the media, and transfer or alter their own understanding about issues/aspects about teaching which are raised in the media clips.

Constructivism plays a part in shaping the way Educational Technology, as a field, is approached, by both teacher educators and student teachers. In recent years, elements of Constructivist theory have been called upon to justify the use of technology, especially ICT-based technologies, for classrooms around the world, in various academic and professional literatures. General claims made to link the Constructivist theory with the use of technology, and subsequently, the benefits of using Constructivism for teacher training are threefold: they allow room for reflection, encourage collaborative learning and enable the 5-E model to be used.

a) Constructivism allows room for teachers to reflect on their own thinking processes, as it provides an opportunity to visualise their thinking processes graphically when they illustrate the connections they make between one teaching step and another (Gagnon & Collay, 1996).

b) Constructivism also encourages collaborative learning, for both teachers and students, and the learning community built from the collaboration helps teachers to minimise their anxieties and risk-taking, and hence enables trust-building among the teachers (Gagnon & Collay, 1996).

c) The 5-E model (Engage, Explore, Explain, Elaborate and Evaluate) which was developed by Roger Bybee, with the Biological Science Curriculum Study in Miami, provides a unique opportunity for teachers to create lesson plans according to different levels of difficulty. The 5E model is based on the principles of Constructivism, and it helps teachers to clearly see how to "bring to each learning experience our developmental level, (their) personal story and (their) personal style" (Miami Museum of Science, 2001, p.1).

An example of how Constructivism was used to justify the use of Educational Technology in the classroom can be seen in an online workshop series created by the Educational Broadcasting Corporation (Thirteen Ed Online Team, 2004). The workshop series highlighted that the use of ICT can help in developing students' thinking skills, developing their communication and social skills, encouraging alternative methods of assessments, helping students to transfer skills to the real world, and promoting intrinsic motivation to learn. This suggests a rather simplistic representation of how Constructivism is perceived through the eyes of educators. The list is a perfect example of how complicated concepts of Constructivist theory are broken down and presented to teachers in similar formats. This is an easy strategy to promote the advantages of using Constructivism in the classroom. Numerous websites today utilise similar presentation formats, mostly targeted at teachers and educators, who are interested in using technology in their classroom. Evidence of practice is a clear indication of how Constructivism is applied in classrooms. They emphasise the cognitive processes and relationships built between these processes and real-world scenarios. Constructivism is also perceived to provide a better opportunity for students to understand and digest the knowledge that they are learning. It also presupposes that with the interaction that is triggered and takes place during the knowledge acquisition process, learning becomes more meaningful than when the behaviourist theory was used in conventional learning settings.

Constructivism accepts that the student takes ownership of his or her own learning process. A teacher using a Constructivist approach in the classroom may have to unlearn and re-learn his/her role in the classroom. The teacher becomes less of the conventionally accepted figure as the sole point of authority and knowledge in the classroom. In Constructivist classrooms, learning is planned to be more learner-centred. Teachers are encouraged to scaffold their instruction to help students engage in meaning-making tasks and activities. The learning environment is designed to continuously facilitate the process of active learning.

On the part of the teachers, Constructivism requires teachers to be able to undertake multiple tasks, and this approach departs from conventional expectations of teaching in objectivist-oriented classrooms. According to Hanley (1994), "the Constructivist approach requires the teacher to relinquish his/her role as sole information-dispenser and instead to continually analyze his/her curriculum planning and instructional methodologies" (p. 1). Brooks and Brooks (1993, p. 20) made an apt summation of general characteristics of a Constructivist teacher:

a) Becomes one of many resources that the student may learn from, not the primary source of information;

b) Engages students in experiences that challenge previous conceptions of existing knowledge;

c) Allows student responses to drive lessons and seek elaboration of students' initial responses. Allows students some thinking time after posing questions;

d) Encourages the spirit of questioning by asking thoughtful, open-ended questions. Encourages thoughtful discussion among students;

e) Uses cognitive terminology such as classify, analyse, and create when framing tasks;

f) Encourages and accepts student autonomy and initiative, and is willing to let go of classroom control;

g) Uses raw data and primary sources, along with manipulative, interactive physical materials;

h) Does not separate knowing from the process of finding out; and

i) Insists on clear expression from students. When students can communicate their understanding, then it is accepted that they have truly learned.

The list suggests learning features which are ideal for teaching using technology. A learner who uses the Constructivist approach is expected to be able to multi-task, engage in critical and creative thinking, be independent and self-driven, and is also able to be reflexive about his learning process. These qualities lend themselves directly to features of a learner who will be able to capitalise on the use of technology in a learning process.

There is, remarkably, very limited literature that focuses on successful Constructivist teacher education programmes. Abdal-Haqq (1998) is cited an American project called Foxfire. The project was around a non-profit, educational literary organisation which was fundamentally designed to help teachers and students learn better. Over time, this evolved into a community-oriented project, championed by local people of the Appalachian Mountains. The project was perceived to be effective because it was a living example of a collaborative effort to create a workable framework which helps teachers to use learner-centred instructional strategies, purely based on Constructivist principles. Their teaching-learning framework is made up of eleven core practices that describe step-by-step phases that teachers can adapt and integrate into their instructional design.

Although research about teacher education that uses Constructivism is rare, there are numerous interpretations of how Constructivism is thought to be translated into classroom practice. An example is by Starnes (1999), who said that some of the core Constructivist practices include:

a) The work teachers and learners do together is infused from the beginning with learner choice, design, and revision;

b) The role of the teacher is that of facilitator and collaborator;

c) The academic integrity of the work teachers and learners do together is clear;

d) The work is characterised by active learning;

e) Peer teaching, small group work, and teamwork are all consistent features of classroom activities;

f) Connections between the classroom work, the surrounding communities, and the world beyond the community are clear;

g) There is an audience beyond the teacher for learner work;

h) New activities spiral gracefully out of the old, incorporating lessons learned from past experiences, building on skills and understandings that can now be amplified;

i) Imagination and creativity are encouraged in the completion of learning activities;

j) Reflection is an essential activity that takes place at key points throughout the work; and

k) The work teachers and learners do together includes rigorous, ongoing assessment and evaluation (in Starnes, Paris & Stevens, 1999, p. 1).

These suggestions imply a need to expand classroom instruction beyond the conventional constraints of the physical four walls of a classroom. They highlight the priority to encourage individual cognitive development through collaborative engagements with others. They also proposed linkages between the classroom and local communities, as a strategy to bring meaning-making from the real world into classroom scenarios.

How do these examples of Constructivism in practice affect the framing of this research? They illustrate some of current rhetoric about using technology successfully in the classroom, in the way it has revolved around using Constructivism as a theory of learning. It is also clear that collaboration is instrumental in cognitive development, and that class tasks should be designed to maximise the potential for the cognitive and affective development of a learner. As illustrated by the Foxfire Project, Constructivism in technology-enhanced classrooms is believed to be able to radically change the way teaching and learning take place in an educational context. Consequently, one of the research questions of this research is focused on finding out how Constructivism is perceived and how it is put into practice by teacher educators and their student teachers during their training in the use of Educational Technology.

There are several personal perspectives from teachers in the classroom who have attempted to use Constructivism. One study was done by a primary school teacher who described her personal experiences in trying to integrate Constructivist principles into her classroom. In a study she carried out to understand how Constructivism has affected teaching and learning in schools in her district, Matusevich (1995) concluded that, in the Constructivist-oriented classroom, there is a shift from whole class to small group instruction; coaching occurs rather than lecturing and recitation; teachers work with weaker students more often rather than focusing attention on the brighter students which tends to happen in traditional settings; students are more actively engaged, and are more cooperative and less competitive; and students learn different things instead of all students learning the same thing. She also observed that there is an integration of both visual and verbal thinking instead of the primacy of verbal thinking (cited from Collins, 1991). This personal account of her experience captures how Constructivism brought change into the school curriculum and instructional practice, and it came via a bottom-up approach, instead of the conventional top-down approach, because the changes were championed by the teachers themselves, rather than the school administrators. According to Matusevich, the move to use Constructivism in these schools is not without problems. The teachers were challenged from many quarters – doubtful public perceptions about the effectiveness of the new learning approach; assessments were not aligned with content covered in the classroom; students had to perform on standardised tests which did not assess their learning content; standard reporting processes did not match instructional processes that go on in the classrooms; and the structure of class schedules hinder a more flexible use of lesson time. At the end of her paper, Matusevich described a realisation she experienced with her colleagues of the constraining boundaries of the conventional school setting. She claimed that there was limited effort put in by the teachers at the Montgomery schools to use Constructivist principles in their lessons. She proposed that systemic change was necessary to create space for change in existing school structures. She believed that it was an imperative strategy to assist teachers to develop Constructivist-oriented learning experiences in their classrooms.

Though there was no day-to-day account about how teachers struggle with the integration of Constructivist principles into their lessons, it was clear that the teachers featured in Matusevich's study had to make sizeable adaptations to their teaching, especially in negotiating the prescriptive expectations from the existing school curriculum and the self-developmental orientation of Constructivist principles in their instructional delivery. In reviewing Matusevich's article, it also became clear that very little has been said and documented about the adapting phases and challenges teachers go through to buy into using Constructivist principles for their lessons on a daily basis. Teacher reflections on this issue are few and far between, and there is a serious lack of documentation of profound views from teachers who are actively using Constructivism as a pedagogic tool to incorporate technology into classroom practice.

Another personal account from a teacher who has used Constructivism with Educational Technology can be viewed via a weblog created by Örnberg in Netherlands. In her blog posting, Örnberg (2003) reflected:

a) teachers find Constructivism does not work for all students, as students have their individual learning styles, and hence these styles affect the way they respond to the instructional materials presented to them in the classroom;

b) when students are asked to design or create problems using instructional materials provided for them, most of the time they come up with the most basic level of problems, usually addressing factual knowledge that they knew or memorised by-heart from other lessons;

c) teachers have to be prepared that when they ask students to expand on topics/ideas presented in the class, they may not be able to go beyond the factual knowledge level, and hence may not be able to take charge of the discussion flow; this would affect the quality of discussion that the teachers anticipate for the lesson, and they would have to resort to a more objectivist approach to keep the students engaged in the learning process; and

d) Constructivism is a big advocator of independent learning, and some students may not be mature enough to handle their own learning pace and structure on their own, and hence this would impact the teachers' role and scope of involvement in the learning process.

Örnberg's reflections on the way Constructivism affects how teachers perform their roles and achieve their teaching objectives in the classroom illustrate the complex nature of adopting Constructivist principles into teaching. Even if the teachers are ready to use Constructivist principles, the students may not be intellectually prepared or ready to immerse themselves in this learning approach. Constructivist principles are geared towards providing self-efficacy learning, in that learners control their own learning phases, through socially constructed, explorative and discovery-oriented learning strategies. How do teachers cope when students are not competent enough to handle the expectations of a Constructivist-designed lesson? Teachers are put in a difficult position; when they attempt to use Constructivist principles in their classrooms, they not only have to modify their instructional strategies, but also they need to be flexible and competent to handle the different learning styles and needs of their students, which may differ from one topic to another. With the advancements in technology, and the penetration of technology tools into today's classrooms, the job of the teachers becomes more complicated, as they now have to integrate the use of technology and simultaneously attempt to match the learning principles of technology-assisted teaching with Constructivist principles.

Unfortunately, Örnberg's writing did not mention any complications in assessing successes or failures in learning or teaching. In the objectivist approach to teaching, testing is a straight-forward business; students are tested on things they are taught, and most of the time, the evaluation describes clearly the types and levels of attainment which would be gauged by success or failure indicators, as a way to identify how well or poorly a student has progressed. In Constructivism, evaluation and assessment issues are not as straightforward as those employed in the conventionally prescriptive learning theories. Constructivism allows room for students to pace themselves to learn independently. The main challenge for students to succeed is to push their personal drive in their own learning pathway. The openness in learning approach instigates an element of subjectivity in assessment. Questions such as these are warranted:

a) How do we gauge the success or failure levels for personal learning processes, as we delve further into the more prescriptive learning theories?

b) How do we measure success and failure when learners engage in different learning styles and paces?

c) How do teachers react and respond to different paces and styles of learning every single day?

These questions need to be addressed in any implementation of instructional strategies, especially in assisting teachers to understand the modification of their role as a teacher in a Constructivist-oriented classroom.

The personal accounts of the two educators cited above are useful reflections, because they are from those who have had first-hand experiences using Constructivist principles with Educational Technology in their classrooms. These personal accounts also point to the importance of personal stories about using Constructivism. The first-hand explanations about how a teacher or a student struggles and reflects the process of using Constructivism can provide rich details which may not be captured through pre-determined questionnaire surveys. The educators' reflections have provided a strong justification for this research to adopt a qualitative approach for data collection, to capture idiosyncratic accounts of beliefs and classroom experiences from every individual participant who will take part in this research.

It is perhaps timely to reflect on the educator's maxim about teaching, at this point in the chapter, as stated by Hoover (1996):

> Teachers teach as they are taught, not as they are told to teach. Thus, trainers in Constructivist professional development sessions model learning activities that teachers can apply in their own classrooms. It is not enough for trainers to describe new ways of teaching and expect teachers to translate from talk to action; it is more effective to engage teachers in activities that will lead to new actions in classrooms. (p. 1)

If the teacher educators themselves have never experienced learning using Constructivist principles, how would they be able to demonstrate knowledge and skills about Constructivist teaching to their student teachers? How do teacher educators demonstrate and model learning activities that integrate Constructivist principles, if they have never undergone any teaching or learning process using these principles? How would they convince student teachers to use Constructivist principles, if they have not seen them in action and been successful with them in their own teaching and learning experiences? While there have been questions raised in various research studies about understanding issues faced by teacher educators in preparing teachers to teach (Ducharme, 1986; Dickinson, P., Eade, F., Binns, B., Craig, B., & Wilson, D. (2004), there is undoubtedly a gap in current research – to date, there is currently no consistent, replicable and tangible research design to find out how teacher educators are teaching about Constructivism or how they are teaching in a Constructivist manner, nor the impact of such a teaching approach on future practices of new teachers, particularly in teaching with educational technology.

4.3.2 Espoused Constructivism and Constructivism-in-Action

In this section, Espoused Constructivism and Constructivism-in-Action are defined, based on previous literature that has looked at interpretations of Constructivism and Reflective Learning Theory, both perceptually and in practice, to understand how these concepts will be employed in the context of this research.

Constructivism has been interpreted in various ways throughout history. In a paper by Oxford (1997), it is argued that the shape-shifting nature of Constructivism's concepts affects the way the theory is dealt with in teacher education. In this section, the focus is not on the interpretations of Constructivism as a theory of learning, but rather on the interpretations of Constructivism as perceived and practised by teacher educators and student teachers, within the context of teacher education. To illustrate this, there is a comprehensive study by Tenenbaum, G., Naidu, S., Olugbemiro, J., & Austin, J. (2001) that looked at instructional strategies employed for distance learning at the higher education level. Although Constructivism has been articulated in numerous papers related to ICT and education, there is scarcely any literature that has looked at interpretations of Constructivism among teacher educators, as presented here in the Tenenbaum study.

Methodologically, the study investigated the presence of Constructivist teaching in higher education. They used seven Constructivist teaching constructs, to analyse practice:

a) Arguments, discussions, debates;

b) Conceptual conflicts and dilemmas;

c) Sharing ideas with others;

d) Materials and measures targeted toward solutions;

e) Reflections and concept investigation;

f) Meeting student needs; and

g) Making meaning, real-life examples.

The participants in the first part of their study are experts in the Constructivist field, have published extensively in the field mostly from the United Kingdom, the United States of America, Canada, New Zealand and Australia. They deliberated in an online discussion forum about the tenets of Constructivist teaching and learning. Outcomes from the discussion were then mapped onto the syllabus of an actual course which was offered both as an on-campus course and a distance learning course.

Their study revealed how Constructivism is perceived differently, and in some cases, quite ambiguously, by different participants in their sample group. Findings from the research provided the authors four categories of Constructivist strategies identified in instructional design processes (Tenenbaum *et al.,* 2001):

a) project-based learning environments;

b) case-based learning environments;

c) computer-based supports; and

d) mind tools (cognitive amplification tools).

Analytically, the findings of the study essentially revealed gaps in the way Constructivism was perceived and practised by experts. The study revealed the current state-of-play on differing conceptions of what Constructivism is, and how it was actually put into practice in actual lessons. Gaps between talk and practice were also present, and this was revealed through a set of indices utilised as the analytical tool in the study. The seemingly open nature of Constructivist philosophy promotes anyone having the ownership to create and decide on their own meaning-making processes. It has, in a way, become a double-edged sword, in the context of training teachers to use Constructivist principles in their lessons.

The Tenenbaum et al. study has provided a strong case for this research to examine similar concerns about how Constructivism is interpreted conceptually and in practice, within the teaching fraternity.

In the context of this research, the term Espoused Constructivism represents personal conceptions about how Constructivism is defined and put into action. The term Constructivism-in-action represents actual evidence of practice which demonstrates the use of any Constructivist principles in an action, or any tangible evidence of action.

The Tenenbaum study revealed how Espoused Constructivism has affected the design and delivery of an online course. However, it lacks data of a comparative nature; it did not present findings about how the espoused versions compare to actual teaching and learning experiences and instances within the online course. It also did not compare courses which use a face-to-face format, and it did not compare a variety of teaching strategies using different instructional formats across different universities.

4.4 Summary

This chapter has provided a review of how Reflective Theory is used to examine espoused theories and theories-in-action in this research. It also presents the position of Constructivist Theory in learning with technology, and how the theory is treated in teacher education settings. This chapter has also looked at several suggestions by scholars and researchers who experienced learning environments that successfully adopted Constructivist principles. It also highlighted the challenges faced by educators who attempted to use Constructivism in their classrooms, and discussed several interpretations of the teacher's role in a Constructivist-oriented technology-enhanced classroom. Tenenbaum's study, in particular, provides a guide to designing the conceptual tool for this research. The chapter as a whole provides an understanding of the position of Constructivism as a theory of learning that has evolved to become a popular pedagogical approach to teaching with technology. It is interesting to note that there is limited literature that investigates or discusses challenges facing teacher educators in trying to incorporate Constructivist principles in a technology-enriched classroom.

In the next chapter, a methodology is developed drawing on key findings from the reviews presented in these last three chapters. The research methodology will explore relationships of the various key concepts selected for this research.

Chapter 5: Methodology

5.1 Introduction

This chapter presents the research design of this thesis, which is built on these research questions:

a) What are the espoused theories and theories-in-action of teacher educators and student teachers that reflect their teaching and learning of Educational Technology courses?

b) What are their interpretations of Constructivism in their teaching and learning of Educational Technology?

Both questions focus on the development of teacher knowledge. Educational Technology is used as the subject matter to provide a context for this research.

This research examined one aspect of teacher knowledge within the process of teaching and learning, in selected teacher training programmes in Malaysian universities. While the first question looks at the more general aspects of teacher knowledge, the second attempts to explore an example of Pedagogical Knowledge in more detail, which is the use of Constructivism as a pedagogical approach in teaching and learning of Educational Technology.

Both questions utilised the Reflective Learning theory to investigate teacher learning (TPCK). The first question focused on looking at how each of the TPCK framework's teacher knowledge types was addressed in Educational Technology courses. This allowed the research to identify and examine gaps between beliefs and actions of teacher educators as well as their student teachers about how they learn and teach Educational Technology.

The second question is a subset of the first research question. While it also analyses espoused theories and theories-in-action, it concentrates on how Constructivism, as a theory of learning, is dealt with in the same Educational Technology courses.

5.2 Educational Technology as the Bridge between Content and Technology

The Association of Educational Communications and Technology (AECT) gave a well-used definition of Educational Technology: "It is the theory and practice of design, development, utilisation, management, and evaluation of processes and resources for learning" (Seels & Richey, 1994). The definition suggests an aligned instructional strategy is needed to bring together the theoretical and practical needs of those designing learning content, using the most relevant type(s) of technology to supplement and enhance the teaching and learning processes. This suggests that Educational Technology would be an ideal opportunity to investigate teachers' developing knowledge about the relationship between technology and educational practice.

The researcher's own experience in teaching Educational Technology in Malaysia for seven years prior to undertaking the research confirmed this. For these reasons, it was decided that this research should focus on Educational Technology courses. The Educational Technology courses which are taught in teacher education programmes in the country are primarily used as the tool to introduce technology to teacher training.

All universities in Malaysia are required to comply with guidelines determined by the Malaysian Qualification Agency (MQA). In 2003, MQA produced a document titled *Guidelines on Standards of Specific Disciplines at Bachelor Degree Level* (2003). One of the programmes described was Education. The curriculum standards for all education programmes are specified in this document, which listed Educational Technology as a compulsory course under the Fundamentals of Education category. Educational Technology is separate from other core courses, and covers the technology aspects in Education. The full description of Programme Design is included as Appendix L.

A study by Masood (2010) compared the curriculum of Educational Technology courses at teacher education programmes in Malaysian universities. The goals of the study were to determine if and how Educational Technology courses at four local universities in Malaysia addressed the prescibed skill sets of ISTE NETS·S (2008) (International Society for Technology in Education (ISTE) National Educational Technology Standards (NETS)). In her findings, it was revealed that Educational Technology courses were offered as a three-credit course at each university. Though the Educational Technology courses had similar learning content, the courses were taught using slightly different approaches from each other. The study found that the courses lacked "digital-age learning experiences" and "engagement in professional growth and leadership", two of the five specific skill sets prescribed by ISTE NETS·S (2008).

Masood's study, however, did not explore whether any of the Educational Technology courses acted as a "bridge" that could link a learner's Content Knowledge and Technology Knowledge specifically. Neither were the contents of courses examined to find out if technology is used when teaching content knowledge or pedagogical knowledge. However, when the four universities' Educational Technology courses were compared using the "Design and Develop Digital-Age Learning Experiences and Assessments" category, all of the courses were found to use instructional design models as their main tool to guide students in creating Educational Technology materials to support learning. The study revealed that in these four universities, the requirement to develop pedagogical knowledge within the Educational Technology courses for pre-service teachers was addressed through the use of Instructional Design models. However the findings did not explicitly describe the depth of content covered or the tasks undertaken within each Educational Technology.

5.3 Research Framework

TPCK framework by Mishra and Koehler (2006) is adapted in this research. The adapted version is used to capture espoused theories and theories-in-action, and beliefs and evidence of using constructivist principles.

a) Espoused theories and Theories-in-action

   By using the principles of Reflective Learning theory, the "espoused theories" are represented by the participants' own judgments about what they believe they did in their teaching or learning process. The "theories-in-action" are represented by the evidence collected in the research that proved an action or behaviour did exist to indicate that the participants actually performed the action or behaviour.

b) Beliefs and evidence of using Constructivist principles

> By using the principles of Reflective Learning theory, the participants' conceptions about Constructivism are captured. Evidence (narratives and artefacts) are collected to prove the utilisation of Constructivist principles in the courses observed in the research.

Figure 5.1 on the following page presents the researcher's perspective on how the original TPCK model is adapted to provide the research framework for this thesis.

The adapted version of the TPCK model considers elements from Reflective Learning theory, and terms such as "Espoused TPCK", "TPCK-in-Action", "Espoused Constructivism" and "Constructivism-in-Action" are used to label key areas of interest in this thesis. To simplify the mapping of evidence, particularly for the two different sets of evidence needed to represent Espoused theories and Theories-in-Action, this research used this adapted version of the TPCK model to highlight the two new formats of looking at TPCK.

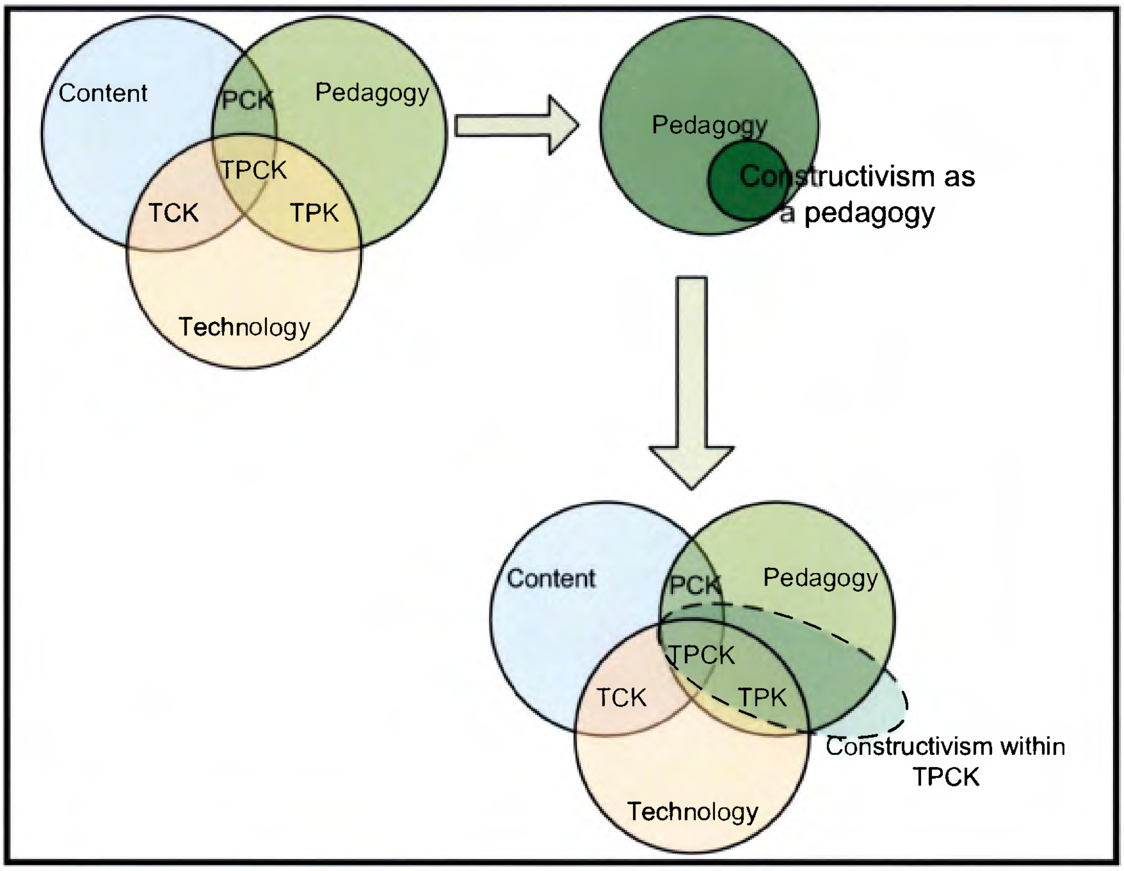

Figure 5.1: The Positioning of Constructivism in the TPCK Framework

With changes made to the original TPCK model, the new model is labelled as T*he adapted TPCK framework*, as shown in **Figure 5.2**:

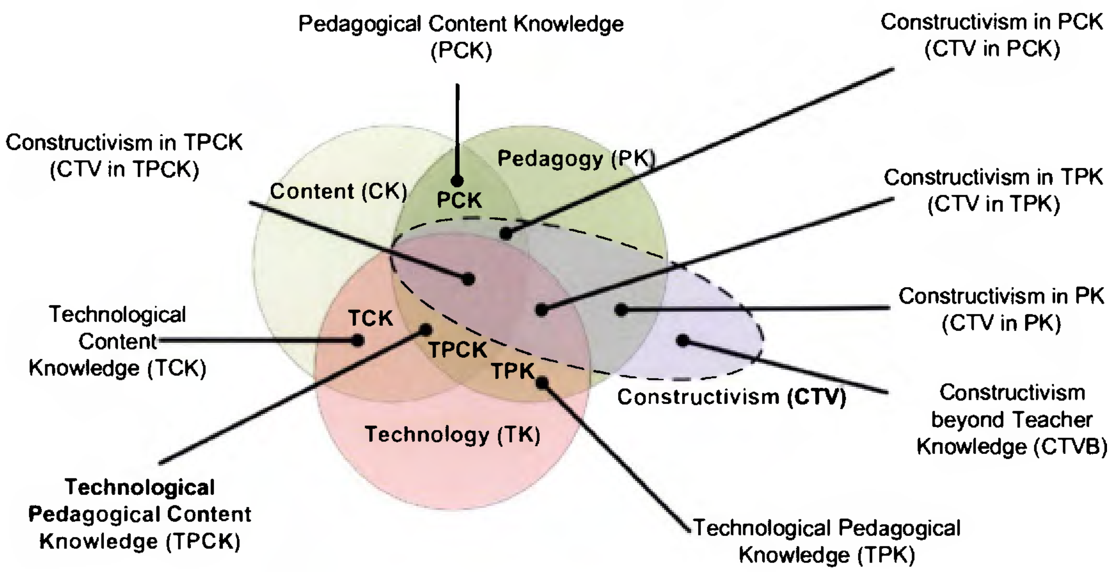

Figure 5.2: Adapted TPCK Framework which is used as the key tool in methodological design in this research

Figure 5.2 illustrates the relationships between each of the teacher knowledge types which will be explored in this research. Three basic components make up the key sections of this research, as they have done in previous research using TPCK; namely, Content Knowledge, Pedagogical Knowledge and Technological Knowledge. Content Knowledge represents subject-matter discipline knowledge, such as Mathematics, Science, Geography and so forth. Pedagogical Knowledge represents instructional knowledge, encompassing understanding about educational philosophies, beliefs, approaches and delivery strategies that help an educator to design and deliver effective instruction. Technological Knowledge represents comprehension about technical facts and skills related to one or more technology tools or systems.

There are four important sectors in the model that emerge from the overlapping basic knowledge types introduced in the conceptual model. Pedagogical Content Knowledge represents the integration of Pedagogy and Content knowledge, where Content Knowledge is delivered using appropriate Pedagogical principles to match the Content being taught. An example for this concept is when a teacher uses drill-and-practice as a pedagogical strategy to teach multiplication tables to seven-year-olds.

Technological Content Knowledge represents the deployment of appropriate technical knowledge and skills that match the characteristics of the Content Knowledge. An example of this concept is when a teacher illustrates the process of a volcano eruption through visualisation in a set of PowerPoint slides.

Technological Pedagogical Knowledge refers to the integration of technical know-how with pedagogical constructs. It reflects that adaptation of appropriate features in a technical gadget or system that can enhance pedagogical qualities of instructional delivery. An example of using this knowledge type is when synchronous communication tools (for instance, MSN Messenger) are used in a Distance Learning course that encourages its students to share ideas and debate the topics they learn in the course.

Finally, Technological Pedagogical Content Knowledge refers to the integration of all three major sectors in the TPCK model. The integration creates an instructional instance which considers the best possible pedagogical construct and appropriate technological features to enhance the learning of selected subject-matter content. An example of this would be a course on Asian History that uses a Blended Learning Approach; the students and instructors use an E-learning system to collate notes and collaborate on course projects, and the instructors choose specific tools within the E-learning system (like Chat, Online Forum, Blogs) to supplement content and activities addressed in class.

The treatment of Constructivism is also investigated using the adapted TPCK framework. The addition of a specific pedagogic theory brings five new components to the TPCK model. They illustrate the treatment of Constructivism in alignment with the use of Technology, Content and Pedagogical Knowledge.

Figure 5.2 illustrates how Constructivism (as a learning theory) principally belongs in the Pedagogical Knowledge sector, but it also represents uses of Constructivism beyond the scope of teacher knowledge, for instance, its presence in the fields of Philosophy, Sociology and so forth. It refers to the use of Constructivist principles beyond the scope of Content, Pedagogy and Technology knowledge, but within the broader field of instruction. An example would be using Constructivism in deciding the philosophical approach to design instructional strategies for the teaching of Mathematics for 16 year old students.

Constructivism within PCK represents the integration of Content Knowledge and Pedagogical Knowledge, and it clearly uses Constructivist principles as its pedagogical construct. An example of this knowledge type is teaching Geography by creating activities where students have to discover different types of soil and identifying the similarities and differences between them, before the original locations of the soil are revealed to the students.

Constructivism within TPK also represents the use of technical features in parallel with Constructivist principles. An instance of using this knowledge type would be when an instructor uses a Social Networking tool (for example *Ning* and *Facebook*) to get students to introduce each other, create their online profiles, and create groups with peers. The students are given an online space, and they are asked to discover the space independently, and to initiate online teams to discuss assigned topics in the course.

Constructivism within PK represents the use of Constructivism as the pedagogical theory of choice, differentiating it from all other pedagogical theories that could be used for instruction. An example of this is when an instructor prepares students to explore the mechanics behind building an environment-friendly house. Different sets of guide sheets are prepared by the instructor. Students are asked to discuss using the questions and graphics provided in the guide sheets. They are asked to share information about the different aspects of house building with each other through collaborative work.

Constructivism within TPCK, similarly, excludes the use of other pedagogical theories, in the integration of Content, Pedagogical and Technology knowledge within the TPCK model. An example of using this knowledge type is when a course on Chemistry uses activities which promote active meaning-making among its students, using Web 2.0 collaboration tools to enable students to implement their class projects online and offline, with assistance from the course instructor, who facilitates the learning process.

The adapted TPCK framework is used as the language for this research to describe findings and analysis. The different sectors identified in the illustration will be considered, because they represent the relationships between each research component identified in this thesis.

5.4 Framing the Use of the Adapted TPCK Framework

The premise of this section is to present an attempt to use the adapted TPCK framework to analyse previous studies which have been conducted in the same field of interest. Both studies are visually analysed and categorised using the framework as a way to understand the feasibility of using the framework for this research. More importantly, the use of the adapted TPCK framework in these two studies contributes to the development of the overall methodology for this research.

Both studies were carried out on a large scale. The two studies had implemented two different methodological approaches in their studies. The comparison between framing, analysis and categorisation with these two studies is essential for this research to gauge how research in this area is typically approached.

5.4.1 The Russell Study

In the United States, Russell, M., Bebell, D., O'Dwyer, L. & O'Connor, K. (2003) conducted a large-scale study, conducted in a two-phase three-year project, involving 2894 teachers in 22 districts in Massachusetts. The research set out to analyse the patterns of technology usage by teachers, in order to determine the scope of curriculum content that needed to be put in place in pre-service and in-service teacher preparation programs, specifically in the use of technology in the classroom. The research is aptly termed USEIT ("use, support, and effect of Instructional Technology"), to reflect its focus on the use of instructional technology in schools. The USEIT study aimed at exploring three basic issues identified on the enhancement of teacher ability to use technology in the classroom. Specifically, its objectives were to:

a) Identify ways teachers use technology for professional purposes;

b) Examine the levels of teachers' comfort with technology to perform professional duties; and

c) Find out the extent to which new teachers are comfortable with technology and using it for professional purposes.

Russell's study identified four useful categories to determine types of technology usage, which are technology for:

a) Instructional delivery;

b) Instructional preparation;

c) Instructional accommodation, and

d) Communication.

Methodologically, this research used a quantitative approach to capture frequency data on how often the identified technology tools were used in the classrooms, by the observed student teachers. This methodology characterises a particular tradition of research about technology application in Education. While it has merit in terms of illustrating the usage patterns for the sample groups involved in each study, the study did not attempt to capture narratives about quality of use of the technology tools, which may have been more useful as a way to inform practice. Issues regarding the integration of technology in an instructional delivery are not addressed in the study. Such findings would have been useful in order to understand how teachers cope with teaching with technology in day-to-day classroom practice.

In this study, data collection was done through a survey and a series of site interviews, and the items were broadly based on the 'what' and the 'how' of technology usage among teachers in Massachusetts. The interviews gathered information about the kinds of expectations held by school authorities about the student teachers, in the way they handled technology in the classroom. Through interview sessions with the school administrators and principals, the researchers found out that the majority of those in managerial positions did not have a clear understanding about teachers' use of technology and there were no clear strategies to evaluate their uses. They also found that teachers' beliefs about technology must be changed to engage them in using technology for instruction. One strategy, suggested in the study to affirm teachers' belief in technology, was to expose them adequately to technology tools while in teacher preparation programmes.

5.4.1.1 Analysis using the Adapted TPCK Framework

If components of this study are mapped on the TPCK model, it is evident that the teacher education programme focused on four out of some of the types of teacher knowledge described by the TPCK framework.

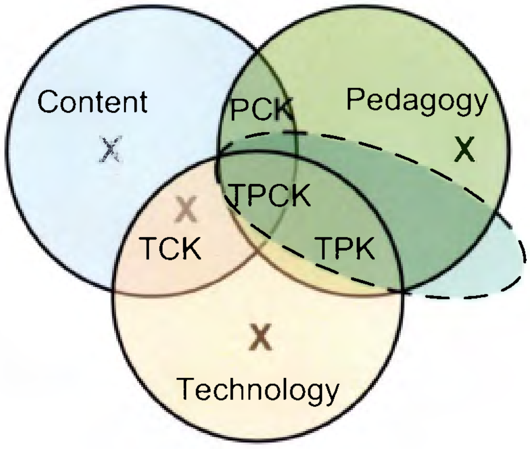

Figure 5.3: Russell's Study Analysed with the Adapted TPCK Framework

Spaces marked with an X indicate the types of teacher knowledge addressed in the Russell study. They also illustrate gaps in addressing crucial types of knowledge for teachers to be effectively prepared for their teaching careers in schools. As indicated in **Figure 5.3**, the knowledge areas marked X are: content; pedagogic; technology, and technological.

a) Content Knowledge – it is clear that the teachers covered this knowledge type, because they were teaching a specific subject matter discipline at the school where they participated in this research. The content knowledge they were teaching was used as the key component to define the scope of investigation for the Russell study.

b) Pedagogy Knowledge – the teachers used pedagogical knowledge to design and to deliver instruction to their students; but it was not documented whether the teachers integrated content knowledge and pedagogical knowledge (PCK) when teaching.

c) Technology Knowledge – the teachers were using technology in their classroom, and this was documented in terms of frequency use of technology tools in their lessons.

d) Technological Content Knowledge – the teachers matched the technology tools and materials they used with the subject matter discipline they were teaching, for instance, teaching science using software that covered similar topics as those presented in the classroom.

Based on the findings of the study, TPCK has not been dealt with in the study. The focus of technology use was on the managerial and technical functions of technology.

The categorisation was made as shown the Analysis Table below.

Table 5.1:

Analysis table that presents knowledge types, evidence of existence/practice and status of existence for Russell's study

Knowledge Type	**Evidence of Practice/Existence**	**Status**
Content Knowledge	Teachers were teaching at least one subject matter discipline during study	Present
Pedagogical Knowledge	Teachers were required to prepare lesson plans that incorporate use of pedagogical knowledge	Present
Technological Knowledge	Teachers utilise the technical use of the technology tools. This was observed in this study.	Present
Pedagogical Content Knowledge	None recorded.	Nil
Technological Content Knowledge	Teachers used technology tools that suited the lessons they were teaching. This was observed in this study.	Present
Pedagogical Technological Content Knowledge	None recorded.	Nil
Constructivism in CK	None recorded.	Nil
Constructivism in TK	None recorded.	Nil
Constructivism in PCK	None recorded.	Nil
Constructivism in TPCK	None recorded.	Nil
Constructivism	None recorded.	Nil

In retrospect, this study did not set out to look for specific evidence of practice as categorised by the TPCK model. However, mapping the findings of the study onto the TPCK model helps to frame an understanding of the design of the study as a whole. The mapping graphically presented how technology use was observed in the study. With the categories of data indicated in the TPCK model, it is clear that the study looked at capturing the frequency of use of technology tools by the teacher trainees, rather than analysing the relationship of the technology use to the building of pedagogical and content knowledge.

On the epistemological perspective on knowing about using technology, the mapping above did not illustrate the extent and depth of the participants' knowledge about their use of technology. The paper did not report on this aspect of technology usage.

5.4.2 The Williams Study

In Scotland, a study by Williams, D., Coles, L., Wilson, K., Richardson, A., & Tuson, J. (2000). was carried out to:

- Investigate teacher needs in knowledge and skills in relation to the effective use of ICT; and
- Suggest ways of enhancing future design and delivery of self-development and staff-development in order to increase and improve the level of ICT use in Scottish schools.

The sample group was also large; 300 primary schools and 100 secondary schools were selected at random, and they participated in the mixed method approach study which comprised a questionnaire survey and in-depth interviews. The response rate was reported at 18 percent for primary schools, and 37 percent for secondary schools.

Methodologically, this study used a mixed method approach to collect data, using both qualitative and quantitative approaches. Most of the questionnaire items were designed to gather data on two items; firstly, the usage of tools by the teachers in the classroom; and secondly, access to technology facilities in their respective schools. The findings revealed that the Scottish teachers who participated in the study were still at the very early stages of ICT adoption. Williams *et al.* also noted that the data they acquired from the interviews "echo observations elsewhere" (Ridgway & Passey, 1995; Cox, 1997) in displaying "some preoccupation with teaching ICT rather than teaching with ICT" (p. 1).

This study is also representative of many similar studies about ICT in Education that focus on patterns of technology usage. Most have placed very little emphasis on teachers' integration of technology tools into their pedagogical approaches for an instructional setting. This study used a bigger sample population than the Russell study and although the objectives seem to point in the direction of investigating "teacher needs about knowledge and skills in ICT," the actual research design did not consider the concepts of teacher learning nor teacher knowledge in general. The focus of its methodology was solely on patterns of usage, which were used as an indicator of "teacher needs" for ICT use in the classroom.

The Williams study is mapped onto the TPCK model. It reveals gaps in the way teacher knowledge about learning to use technology is interpreted, especially in the context of using technology in the classroom (**Figure 5.4**).

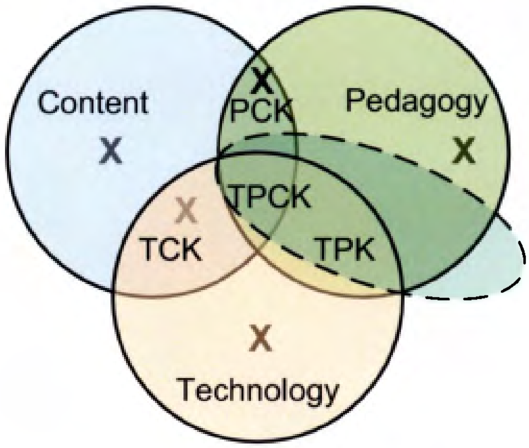

Figure 5.4: William's Study Analysed with the Adapted TPCK Framework

Figure 5.4 illustrates how five of the eleven types of teacher knowledge were addressed in the teacher training. The five knowledge types were content, pedagocical, technology, pedagogical content and technological content.

a) Content Knowledge – It is clear that the teachers were teaching a specific subject matter discipline when they were assigned to teach at the school. Though this type of knowledge was not clearly reported in this research, it is deduced that the student teachers were teaching at least one subject during the research observation because the research looked at how the teachers used technology in their teaching. However, it is unclear from this paper if and how content knowledge was observed in the study.

b) Pedagogical Knowledge – Teachers to create and design lesson plans before they teach any lesson. This routine suggests that pedagogical knowledge was addressed when they taught in the schools. However, it is unclear from this paper whether and how pedagogical knowledge was observed in the study.

c) Technology Knowledge – Technology knowledge was put into action in their teaching sessions, because the research specifically looked at the types of technology they used in the class, and the technical skills which they had employed to use the technology tools.

d) Pedagogical Content Knowledge – This is deduced from the reporting of this study in the implementation of lesson plans when observed by researchers in this study. This meant that there was some instance of pedagogical content knowledge present when this study was carried out.

e) Technological Content Knowledge – This is deduced from the reporting of this study. The researchers looked at the use of software and materials related to the subject matter discipline taught by the teachers in their classrooms.

From the mapping, it is clear that the study did not observe two types of teacher knowledge: technological pedagogical knowledge (TPK) and technological pedagogical content knowledge (TPCK). To understand why technology works or does not work in classroom settings, both types of teacher knowledge are important.

The categorisation was made as shown the Analysis Table below.

Table 5.2:

Analysis table that presents knowledge types, evidence of existence/practice and status of existence for William's Study

Knowledge Type	Evidence of Practice/Existence	Status
Content Knowledge	Teachers were teaching at least one subject matter discipline during study, though this was not clearly indicated in the paper.	Present
Pedagogical Knowledge	Teachers were required to prepare lesson plans that incorporate use of pedagogical knowledge. However this was not clearly indicated in the report.	Present
Technological Knowledge	Teachers utilise the technical use of the technology tools. This was observed in this study.	Present
Pedagogical Content Knowledge	Lessons were observed in the study, suggesting that this type of knowledge was present during the time of study.	Present

Technological Content Knowledge	Software resources were observed in this study, though it was not clearly indicated if teachers were using the materials.	Present
Pedagogical Technological Content Knowledge	None recorded.	Nil
Constructivism in CK	None recorded.	Nil
Constructivism in TK	None recorded.	Nil
Constructivism in PCK	None recorded.	Nil
Constructivism in TPCK	None recorded.	Nil
Constructivism	None recorded.	Nil

The most striking difference between the Russell and Williams studies is that the Russell study looked at student teachers who are about to complete their teacher education programmes, while the Williams study looked at teachers who are already working in schools. However, the main research question is very similar – both studies aimed to look at how teachers integrate ICT in their teaching process. Both studies employed a mix of quantitative and qualitative approaches, although to varying degrees and depth. However, neither studies were designed to observe the development of teacher knowledge, specifically from the perspective of adapting pedagogy for using technology in the classroom. Most significantly, both studies represent a good example of how studies in the field of ICT in Education are commonly carried out.

This section has provided an understanding about how the adapted TPCK framework could be used to map findings from a research in this field. Although the studies did not focus on similar issues to those identified for this research, particularly in looking at how the use of technology is taught within teacher training, most significantly, both studies represent a good example of how studies in the field of ICT in Education are commonly carried out.

5.5 Unit of Analysis

The focus of this research is to capture espoused theories and theories–of-action from teacher educators and student teachers. Therefore, the unit of analysis is the individual. A case-study based approach was used to capture data from participants in the study. Within this context, evidence about particular individuals (e.g. student teachers and teacher educators) were elicited and analysed. The findings were compared between the case studies in order to draw conclusions about the way teacher knowledge was treated in the participating teacher education programmes. The case-study approach allows for richer, unique and in-depth quality of information. Data were acquired from face-to-face interviews, classroom observations, and collections of classroom artefacts from both teacher educators and their student teachers.

To be able to portray espoused theories, evidence of espoused theories will be collected from:

a) Narratives/discourse/self-descriptions which will be elicited through semi-structured interviews; and

b) Classroom artefacts which have been produced as part of the teacher education programmes (such as handbooks, lesson plans and assignments) as they may contain expressions of beliefs, or at least, some level of support for inferences about these beliefs.

To capture illustrations of theories-in-action for this research, these activities were undertaken:

a) Collection of classroom artefacts from teacher educators and student teachers which exemplify how they act out their beliefs about teacher knowledge in their Educational Technology courses; and

b) Recording of classroom behaviours and actions (using either video cameras, field diaries or audiotapes) to represent examples of these teacher educators and their students in action, while they are on task, in their respective learning environments.

The units of analysis for issues concerning the treatment of constructivist principles were similar to those used to obtain data for teacher knowledge. To be more precise, the constructivist elements that will be focused on in this research are based on those identified in Tenenbaum's study:

a) Arguments, discussions, debates;

b) Conceptual conflicts and dilemmas;

c) Sharing ideas with others;

d) Materials and measures targeted toward solutions;

e) Reflections and concept investigation;

f) Meeting student needs; and

g) Making meaningful, real-life examples.

These elements guided the acquisition of data about the treatment of Constructivism in teacher education programmes. Using Reflective Learning theory, these constructivist elements were observed by capturing the reflective thinking process prompted by the semi-structured interviews with both participant groups.

The following section describes the conceptual tool of this thesis which drives the design of the methodological framework for this research.

5.6 Conceptual Tool

The goal of the conceptual tool is to provide a strategy to classify and annotate claims and evidence of teaching and learning practices. The conceptual tool for this research adopted nine types of teacher knowledge. This research employed them to identify and distinguish two perspectives on the development of Teacher Knowledge. The two perspectives are:

a) Espoused theories and theories-in-action about the teaching and learning of Educational Technology; and

b) Espoused Constructivism and Constructivism-in-action in the teaching and learning of Educational Technology.

It has been established that so far there has been limited research about the development of teacher knowledge for professional uses of technology. This research used evidence drawn from narratives and practice to investigate the gaps and points of connection in the reflective process of building teacher knowledge. The conceptual tool allowed for a detailed analysis of the design and development of instructional strategies for the teacher education curriculum, focusing on developing teachers' competencies in using Educational Technology effectively.

The Reflective Learning theory has provided a valuable strategy to articulate the distinctions between perceptions and actions. Exploring the congruence between perceptions and actions is one of the important objectives for this research, because the findings may explain the complexity of training teachers for the professional uses of technology. The categorisation of actions and beliefs as articulated in Reflective learning theory were used to classify evidence of teacher knowledge in the adapted TPCK framework.

A qualitative approach to data collection was selected for this research because it provided a rich and detailed insight. It allows an opportunity to go beyond finding evidence through statistical values (as often reflected in quantitative research studies). Each case study can be explored in depth. Prevalence of generalising findings to a population is not a primary concern for this study.

5.7 Case Study Approach

This research utilised a case study approach to collecting data. The research captured context-dependant cases, where semi-structured interviews, observational data and classroom artefacts were used as primary sources of data. Each case study was analysed using the nine elements of the adapted TPCK framework. The analyses revealed patterns that signify incongruous perspectives on teaching and learning of Educational Technology in teacher training.

The investigation was a two-part process. In the first phase, a pilot study was undertaken to determine the viability of the proposed research scope and methodology; the second phase, the main study, investigated current issues experienced by teacher educators and their student teachers (as identified in the pilot study findings) in the pursuit of professional development.

Table 5.3:

Breakdown of Research Process

	Pilot Study	Main Study
Purpose	To test scope of interviews	To capture narratives and evidence of practice in the teaching and learning of Educational Technology courses
Type of data	Semi-structured interviews (teacher educators and students)	Semi-structured interviews (teacher educators and students) Classroom observation Class artefacts
Target participants	Two universities a) Distance learning format (University X) b) Residential learning format (University Y)	One university – Residential learning format
Criteria for Participant Selection	Teacher Educators: • At least five years teaching Educational Technology • Still actively teaching at the time of interview Student Teachers: • At least in second or third year of study • Have taken at least two Educational Technology courses	Teacher Educators: • At least five years teaching Educational Technology • Still actively teaching at the time of interview Student Teachers: • At least in second or third year of study • Have taken at least two Educational Technology courses
Criteria for Artefact	It is used in any one of the Educational Technology courses taught by the teacher educator interviewed for this study	It is used in any one of the Educational Technology courses taught by the teacher educator interviewed for this study

The target group for this research is the teacher education community in teacher training programmes in Malaysian universities. Due to constraints in time and distance, it is impossible to investigate all eighteen public and two private universities that offer teacher education programmes in the country; hence this research focused on investigating a small selection.

The selection of case sites for the pilot was guided theoretically, based on findings from the literature which suggested courses that use technology (such as distance programmes) could result in different experiences from those which do not use it so extensively (typically, face-to-face programmes). Within the selected sites, recruitment of participants was necessarily opportunistic (opportunity sampling): relatively few individuals were involved in each case as teacher educators, and access to student teachers had to be negotiated, resulting in little opportunity for purposeful selection processes. The process of gaining access was facilitated by the fact that the researcher has contacts in the field established prior to this research.

For the pilot study, two universities were invited to participate. The decision to use the two universities was reached due to the choice of format for instructional delivery used at these universities. University X represents a small but significant fraction of the more recently established universities in the country that capitalised on Online Learning. It uses e-learning to deliver content. University Y offers a residential study programme. It represents the more conventional characteristics of a public university in Malaysia. Hence the participants of this research represented a cross-sectional group of individuals who were actively involved in two teacher education programmes in Malaysia.

Data from the pilot study was used to guide, refine and determine the scope and design of the research methodology for the main study. The focus of the pilot study was to test the viability of the interview items.

In teacher education programmes in Malaysia, Educational Technology courses are considered the bridge between content and technology. Content for Educational Technology courses is made up of knowledge about forms and functions of technology infrastructure and infostructure. Pedagogic knowledge in such a course may come into play during the instructional design work that is often covered in these courses. This was the reason for focusing on these courses: Educational Technology courses are potentially important because their position and focus means that they should, in theory, address all the components of the TPCK model.

There are two main groups in this research – the teacher educators and their student teachers. The teacher educators provided perspectives and discussions about their instructor-level experience in the teaching process, from designing the curriculum to the implementation of instructional practices, and these experiences are important for understanding how Educational Technology is treated from the perspective of educators at these selected universities. To acquire a full picture about the learning contexts involved in this research, student teachers also participated in the research. They were interviewed to present the view of learners in the teacher education programmes. The student teachers' input was crucial in making sense of issues that exist in the selected teacher education programmes. For both study phases, participants who were at least in their second year of study were requested. The students should also have taken at least two Educational Technology courses at the university at the point of the interview.

5.7.1 Data Sources

Data for this research are primarily sought from these sources:

a) One-on-one semi-structured interviews with participants;

b) Classroom artefacts;

c) Classroom observations; and

d) Institutional materials such as university guidelines and materials published by the Ministry of Education and State Education Offices

To simplify the classification of research questions into manageable chunks in the data acquisition process, these four labels will be used to indicate the boundaries of key themes addressed in this thesis:

a) Espoused theories about Educational Technology;

b) Theories-in-action about Educational Technology;

c) Espoused Constructivism; and

d) Constructivism-in-action.

Table 5.4 illustrates the multiple sources of data identified for this research. These provided an opportunity to triangulate the data because the data acquisition represented input from various sources within the same research context. The use of multiple data sources was selected to enable multiple perspectives of the same reality to be captured. According to Golafshani (2003), the method to select to triangulate data to test the validity and reliability of a study depends on what the research considered as its principle. In the case of this research, the adapted TPCK framework has been selected to measure the way teacher knowledge is conceptualised and acted on. Therefore, themes derived from the adapted TPCK framework were utilised in this research to form the basic condition for data triangulation.

In the writing of this thesis, it is noted that the initial research inquiry has evolved through the course of this research. The developments, though unplanned and unexpected, illustrated a constructivist nature in the way knowledge about the issues investigated in this research had evolved over time and experience with the data captured and analysed in the research.

Table 5.4 provides an overview of the data management framework applied.

Table 5.4:

Overview of data management for this research

Research Question	Kinds of data	Source of data	Data collection method
Espoused theories about Educational Technology	Verbal accounts of beliefs, principles and perceptions in relation to what they teach	Teacher educators	Semi-structured Interview
	Verbal accounts of beliefs, principles and perceptions in relation to what they learn	Student teachers	Semi-structured Interview
Theories-in-action about Educational Technology	Artefacts to exemplify espoused theories derived from earlier data (teaching) ; Educational Technology course curriculum;	Teacher educator	Classroom observation, Semi-structured Interview
	Artefacts that exemplify perceptions and interpretations	Student teachers	Classroom observation, Semi-structured Interview
Espoused Constructivism	Verbal and written accounts, to be tallied on constructivist principles identified; curriculum of Educational Technology course, that indicate the application of constructivist principles	Teacher educators	Semi-structured Interview, Classroom observation, Instructional materials
	Verbal and written accounts about Constructivism	Student teachers	Semi-structured Interview

Constructivism-in-action	Lesson outlines/plans and instructional delivery of materials that have been designed using constructivist principles; artefacts used in learning process; interaction accounts in classroom	Teacher educators	Semi-structured Interview, Classroom observation, Instructional materials
	Lesson plans and class projects/assignments (artefacts)	Student teachers	Semi-structured Interview, Classroom observation, Instructional materials

5.7.2 Data Coding and Analysis

This research utilised Miles and Huberman's approach to qualitative data analysis which consisted of three concurrent "flows of activity" (Miles & Huberman, 1994). This approach for data coding and analysis was selected because it provided opportunities to review the research data in a systematic and logical way, with clear milestones to be achieved to mark the end of each activity. The activities of Miles and Huberman's approach are data reduction, data display, and conclusion drawing/verification. Using these three activities, data will be managed and analysed systematically, to provide a cohesive and coherent presentation of results and findings from the case studies collected from the research investigations.

Table 5.5:
Data analysis process

Data Analysis Process	Procedure	Outcome
Data Reduction	Select and group data according to themes identified from the adapted TPCK framework	Themes that illustrate patterns in data which are aligned with types of knowledge identified in the Adapted TPCK framework
Data Display	Match data with themes; select significant ones to illustrate important cues	Extracted data which represent types of knowledge identified in Adapted TPCK framework
Conclusion Drawing/Verification	Review the deductions made from the analysis and proceed to verify position and conclusion based on analysis done	Points for discussion which add value to the classification of knowledge types identified in the Adapted TPCK framework

The process above guided the analysis phase in the study. When conducting the study, each interview was transcribed as soon as each session was completed.

In the pilot study, the interviewees chose not to give their consent for the recording of the interviews, so the researcher depended on her own field notes taken for these sessions. During the interviews, the participants were shown the TPCK framework. An explanation of each component of the framework was offered to each participant. The participants were asked to mark the TPCK framework to indicate the types of knowledge that they thought were addressed in their respective Educational

Technology courses at their universities. These notes were not taken at face value; instead, they were revisited using the researcher's notes as soon as the interview was completed, to generate a parallel interpretation of the narratives from the interview. This allowed different interpretations of the course to be explicitly constrasted and compared. The marked TPCK framework was then used as a point of reference when interpreting participants' claims about the course.

In the main study, all participants agreed to the audio recording of the interviews. Field notes were also taken, however, and these were revisited as soon as each interview ended, to ensure all the important details were recorded. The transcription of the interviews was done approximately one month after the interviews were completed. The transcriptions and translations were made, where necessary, by three bilingual speakers who were conversant in both English and Malay languages. The transcriptions were later sent to another bilingual speaker to verify the content of the transcriptions. Careful consideration was taken to ensure the original meanings intended in the interviews were preserved in the translations.

5.7.2.1 Validity and Reliability

Issues about validity and reliability arise in relation to all empirical work, but can be particularly difficult to address in a qualitative design study such as this. Since the researcher is the sole data collector and analyst, there is a possibility that the reporting could be highly subjective. Within a qualitative case study, however, the emphasis is not on objectivity *per se* but on clarity, transparency and credibility. Rather than aiming to make the work replicable, which would defeat the point of a case study approach, this research focuses on the uniqueness of each case. The work produced for this research is thus intended to be clear and credible. The claims made are categorical, rather than quantitative. The aim was to show that gaps and congruencies can and do exist in courses of this kind. This research intended to explore the types of gaps and congruencies that occurred. In fact, across the case studies, patterns did recur, suggesting that the adapted TPCK framework could be used to explore the prevalence of evidence about the development of teacher knowledge about technology, pedagogy and content within the context of professional development more generally.

In order to help achieve transparency in the analysis, transcripts of interviews are presented as appendices. The analysis of two transcripts (one from teacher educator group, and another from the student teacher group) are presented in the appendices. Excerpts from transcripts are integrated into the discussion in relevant chapters within this thesis, to illustrate how data were analysed, verified and categorised in this research.

To address the aspect of face validity in the study, the framework for the interviews and observations was derived from the types of knowledge defined in the TPCK framework. Before the pilot and main studies were conducted, the data presented in two studies by Russell and William (see sections 5.4.1 and 5.4.2 above) were used to test the viability of the TPCK framework for analysing theories of action within two separate teacher education contexts. In the analysis, which used TPCK's knowledge types, the reporting of data was done by groups of researchers who intended to investigate the use of technology within teacher education settings. Neither study distinguished espoused theories from theories-in-action. However, being able to reach this conclusion demonstrated that the reported data could be analysed using the TPCK framework.

As the study forms part of doctoral research, it was designed as a single-person task, from the conceptualisation to the reporting of data. In the process of acquisition and interpretation of data, there is always a risk of bias or that evidence will be misconstrued, particularly for single-person analysis. The face validity of the study would therefore have been higher if multiple investigators were involved in the process of research; however, it was not plausible to engage any one else in the process because of the requirement of the doctoral study for single-person investigation. However, checks and balances were put in place to avoid these risks. For example, analysis and interpretations were discussed repeatedly with the supervisor, and examples of analysis and interpretation were presented at conferences so as to invite feedback on their credibility. Moreover, further work beyond the doctoral study, that involves multiple investigators, could be undertaken. With inter-rater variance being explicitly considered, further triangulation of sources and interpretations, and multiple approaches to data analysis, the process might be seen as more rigorous and interpretations could be cross-checked through inter-rater processes. The main contention of this study is provide an account of how the TPCK framework could be used to identify gaps between perceptions and evidence of practice about teacher knowledge. Although the data presented through the single-person investigation in this study may not be generalised to all teacher educators, student teachers or universities, it provided an insight into the complex nature of extracting evidence about beliefs and practice among teacher educators and student teachers, illustrating this specifically in the context of Malaysia.

The following chapter describes the pilot study process. The pilot study is an essential component of this research as it provides an opportunity to test the methodological design of the thesis. Findings from the pilot study afforded important initial insights into the research context. The experience and analyses from the pilot study implementation were subsequently used to guide the design of the main study.

5.7.2.2 Ethical Considerations

This type of investigation entailed examining personal beliefs and actions of individuals who voluntarily participated in the research. At the time of interview, the participants were working in their own teaching and learning environments. Questions posed in the research concerned their personal and professional beliefs and actions, particularly how they viewed their professional use of technology in their classrooms. It is noted that there was a possibility for some participants to feel anxious about the responses they provided. They might be inclined to take a calculated, indecisive or even defensive position when responding to questions. They might be driven by personal motives to guard their personal and professional interests and positions. They might be obliged to protect their credibility and reputation as experienced teacher educators or student teachers. The following list briefly describes several issues which it was felt could have raised anxiety among participants:

a) Professional identity and authority as qualified and experienced academics (teacher educators);

b) Professional credibility of teacher education programmes investigated;

c) Personal and professional standing of the student teachers, who were pursuing government-sponsored education programmes, and might feel they should provide a more politically correct viewpoint to shield their personal perspectives in case they jeopardised their government-sponsored scholarships; and

d) Anonymity of participation might be unintentionally revealed, when descriptions about each institution were pieced together with feedback from participants.

Using the British Educational Research Association (BERA, 2004) guidelines as a point of reference to address ethical issues, all participants signed a voluntary informed consent form and all items on the form were explained thoroughly before the participants signed it. They were allowed to exercise their right to withdraw their participation from the research at any point.

As stated in the BERA guidelines, any incentives used during the research process must be conducted in good faith without introducing bias in the data collected. For this research, all participants were offered book vouchers. This offer was made at the end of the data collection process, as a token of appreciation for their time and effort taken to participate, rather than being used to induce participation. Book vouchers were chosen over monetary rewards because the vouchers would contribute directly in meeting their academic needs. Some of the participants declined the offer, but most respondents agreed to accept.

The participants in this research are adults, aged above 18. If any participant expressed or displayed any anxiety or discomfort while participating in the research, the researcher took the necessary precautions to minimise "the sense of intrusion" (BERA, 2004) and attempted to use alternative ways to acquire information (this applied to the interviews and classroom observations). The presentation of data was not directly linked to any participant; instead, labels were used as identification to protect anonymity. Each university which participated was unnamed in the reporting process. As far as possible, the narratives about each university and its teaching and learning contexts were kept to a broad description, as a strategy to mask the actual identities of all respondents.

There is also a concern about the nature of dual relationship for the researcher in the implementation of the research. The researcher is part of the teacher fraternity in the same field of study, and upon completion of the doctoral study, there is a high probability that she will be working with the participants of the study. During the research, the researcher has to probe on teaching and learning beliefs and practices. Conducting the research with the selected participants raises important reflexive questions about the dual role of the researcher both as outsider and as a participant, hence any example of incidents in which personal influence or power-distance relationship arose were noted and these are reported as part of the analysis.

All data collected during this research has been kept confidential, and has been filed in a secure location at all times. The researcher is a teacher educator herself at a university in Malaysia and the participants of the study are made up of individuals in the same field who were working in different universities. The researcher is the sole person who has access to the research data in its entirety. In terms of dissemination, findings from the research are used only in the context of the thesis and relevant academic publications.

The researcher is solely accountable for the acquisition of data and reporting of this research. In this research, narratives were used as one source of evidence to illustrate teaching and learning beliefs. Narratives are highly personal and individualistic, sometimes biased toward a set of beliefs and traditions. The narratives were reported as they were presented to the researcher. In instances where the language used was mixed (particularly between Malay, English and the local dialects), the researcher reports the narratives in the closest interpretations in English, so they could be understood within the context of the research.

Ethical issues that emerged in the course of conducting this research will be reported in the discussion of findings.

5.7.2.3 Right to withdraw

Before the interview schedule was set up, the researcher contacted persons in charge of the Educational Technology modules at each university, to collect names of teacher educators and students who would be willing to participate in the study. The feedback from all contacts was positive; names of teacher educators who were teaching Educational Technology courses were given, and the researcher proceeded to contact them through email. In the email transactions, the teacher educators were briefed about the scope of study and their rights as participants in the study. The dates, timeslots and venues were confirmed in the email messages. The teacher educators were also asked to discover if any of their students would be interested to participate in the study as well. The criteria for student selection were discussed and agreed in the email transactions. However, names of student participants were not given at any instance through the email correspondence, but the researcher was assured that there would be a handful of students who could be approached during the visit to each university site.

Upon arrival at each study site, the teacher educator interviews were conducted first. After the interviews were over, the researcher was told to wait in various rooms at allocated timeslots, and the student teacher participants were sent to meet with the researcher. The participants were briefed about the voluntary nature of the study, and that they had the right to withdraw from the study at any point. No teacher educators or student teachers chose to do so. Each clause of the Informed Consent Form was explained in English and Malay Language, to ensure that the participants understood the intention of the study.

For all case studies in both the pilot and main study phases, the student participants were pre-selected by their respective teacher educators prior to the start of the interviews; however, when they were briefed about the scope of the interview, all of them decided to contribute and be involved in the interviews. They were asked if they understood the risks they took when participating, and all participants gave consent to the use of data they contributed in the study.

5.8 Summary

This chapter has described the methodology for this research. Drawing from key literature highlighted in the previous chapters, a conceptual tool has been formulated to use as a framework to analyse and illustrate the treatment of Educational Technology in teacher education courses in Malaysian universities. Two major theoretical conceptions are utilised as the backbone of the conceptual tool: Mishra and Koehler's TPCK model (2006) and Argyris and Schön's Reflective Learning theory (1992). By adapting both sets of theoretical models, the conceptual tool revealed significant findings about the symmetry and differences in the way teacher knowledge was perceived and acted upon. The conceptual tool also captured the treatment of Constructivism, through the eyes of teacher educators and student teachers, specifically in the teaching and learning of Educational Technology.

The next chapter focuses on the design and implementation of the pilot study, and it will describe and analyse the findings, through the lenses of the theoretical framework for this thesis.

Chapter 6: The Pilot Study – Part 1

6.1 Introduction

This is the first of two chapters that describe the findings from a pilot study which was conducted in the months of May and June in 2005. The decision to divide the chapter into two was driven by the length and depth of data analyses and discussions. The chapters are divided and categorised on a case-by-case basis; Case 1 is presented as Part 1, and Case 2 as Part 2.

The methodology used for collecting data for each case study is described separately in each chapter. The pilot study was designed to test the viability of the research tool. Experience and findings from the pilot study were intended to determine the feasibility of conducting the main study planned for the next phase of this research. Data from the pilot study is expected to illuminate teacher educators' espoused theories and theories-in-action regarding the treatment of teacher knowledge and Constructivism when matched with those of their own student teachers.

The research questions are:

a) What conceptions do teacher educators and their students hold about teaching and learning with technology? Are these consistent with their teaching practices?

b) How do teacher educators talk about and enact constructivism in Educational Technology modules within teacher training programmes?

The pilot study is designed to investigate:

a) The beliefs, principles and theoretical foundations held by teacher educators and student teachers in the teaching and learning of Educational Technology courses in teacher training programmes at Malaysian universities, with regard to developing teacher knowledge in relation to training how to integrate ICT in Education; and

b) The theoretical, design and implementation issues faced by teacher educators and their student teachers, in their effort to integrate Constructivist principles into Educational Technology courses.

The literature review chapters posit that there are considerable gaps in current research about implementation of Educational Technology courses for teacher education programmes. Though many previous studies have recognised the potential empowerment that technology brings into education in general, there is indication that the focus of teaching and learning with technology is on mastering technical knowledge and skills.

6.2 Conducting the Pilot Study

6.2.1 Interviews

There were two types of teacher education programmes identified for the pilot study – University X model and University Y model. A series of interviews was scheduled with a group of teacher educators and their student teachers at both universities.

University X uses the distance learning format for its main instructional delivery. Students at University X are in-service teachers, and they are actively teaching at schools around the country while undergoing the teacher education programme. University X invests in E-learning technology for instructional delivery. All instructional materials and activities are primarily conducted online. Face-to-face contact between course tutors and students is limited to approximately five to six times every semester (16 weeks). Upon enrolment, students are expected to be able to use and have access to technology, particularly email and the Internet, to enable them to access the content management system that delivers learning content, instructions, announcements and other important information related to their courses, programmes and university.

University Y uses the face-to-face format for its main instructional delivery. It offers a programme that is open to all pre-service and in-service teachers, and all student teachers are required to attend a four-year full-time residential programme on campus. Classes are normally conducted during weekdays. Students are required to attend at least seventy percent of the total class sessions, to avoid being barred from sitting their final examinations at the end of the semester. University regulations state that the student teachers are required to attend lectures and tutorials, and normally their class assignments and course projects are designed to build on topics and issues presented in their class sessions. Assignments and projects are usually formatively assessed. Enrolment into the programme is governed by qualification requirements which are pre-determined by the Ministry of Education (MoE), and the university would exercise its institutional authority to select, interview and assess each potential candidate to the programme, before any student is accepted for enrolment. In Malaysia, a merit-based system for student selection was put in place in 2002 (Ghani, 2002). In the new system, students of all races are given equal opportunity to enter the university, and each enrolment is judged based on a student's academic merit. In the past, since the time Malaysia acquired its Independence in 1957, the largest indigenous community in the country are the Malays, and they were given a sixty percent quota for university admission to any public university in the country. This is a national integration agenda designed to ensure Malays would be able to compete on a par with their counterparts from other migrant races in the country, academically, socially, economically and politically.

For both universities, all student teachers who wish to enrol into teacher education programmes are required to apply for study leave from the Ministry of Education. Upon approval, they are required to sign a contract that binds them to return to work for the Ministry of Education, once they complete the teacher education programme. Student teachers who enrol in these programmes have already undergone teacher training at diploma level. One of the main motivations to enrol into teacher education programmes at the university is that the bachelor's degree qualification enables them to qualify for a higher salary scale once they return to teach in schools after they complete their studies.

6.2.2 Participants

The interviews with each participant were conducted on site at their university campuses. Prior communications via email and telephone with all potential interviewees were used to obtain their initial consent to be interviewed. All participants signed the Informed Consent Form (see sample in Appendix B) before any of the interviews took place.

There were eight participants interviewed in the pilot study. Three were teacher educators, and five were student teachers. The teacher educators were interviewed individually. Most of the interviews were done at their offices on campus. The teacher educators who agreed to participate in the interviews held senior positions at their respective universities. All three are male. At the time of their interview, they each had more than twenty years of experience in lecturing. One of them was involved in the curriculum development processes of the teacher education programmes that were being offered at his university.

To recruit participants from the student teacher group, the researcher asked assistance from established contact points at the university. The criteria suggested to be used were that the student teachers must at least be in their second year or third year of study; they should also have completed at least two Educational Technology courses prior to the time of interview. The student teachers were initially scheduled for one-to-one interviews. However, for unanticipated reasons, the students consented to be interviewed in groups of twos and threes. The interviews were scheduled to run for thirty to forty minutes; however, most sessions ran for more than one hour. The main source for interview data is the researcher's field journal because none of interviewees at both universities gave consent to record the interviews.

At University X, some of the student teachers who agreed to participate in this pilot study were nominated by their lecturers (who were the same teacher educators interviewed). The students were experienced school teachers and were in the second and third year of their teacher education curriculum at the time of the interview. The student teachers from University X were completing their studies part-time. They were juggling their studies and full-time teaching jobs simultaneously. Most of the student teachers at University X explained their preference to keep their teaching jobs while studying because they did not want to jeopardise their seniority in their school's administrative line-up. They attended classes during weekends. Their normal routine was to have at least five meetings with their tutors per course. The bulk of the learning was done through self study. The students were given a series of assigned learning materials, via a virtual learning environment platform provided by University X.

6.2.3 Format of the Interview

The interview questions were designed to be semi-structured (see Appendix D). The interview began with an introduction to the research project. The researcher explained the terms and conditions in the Informed Consent Form. If agreeable, the respondents signed their personal forms which were collected by the researcher before interviews began.

The interview questions were designed to obtain narratives about participants' espoused theories and theories-in-action, in relation to how they viewed the teaching and learning of Educational Technology in their respective teacher education programmes. The questions were expected to trigger descriptions about personal interpretations, beliefs and philosophies in handling teacher knowledge, particularly in addressing the integration of Educational Technology for classroom practice. The questions would also prompt them to describe their individual theories of action, specifically the way they handled the process of building teacher knowledge, through their own actions and performances in their learning environments.

In the following section, the first case of the Pilot Study is presented. Data from University X is analysed and discussed in depth. In the subsequent chapter, data from University Y will be presented.

6.2.4 Analyses of the Interviews

6.2.4.1 Interview 1: Teacher Educator 1 at University X (PSTE1)

The first interviewee (PSTE1) was an American-educated academic who has worked in various public universities in Malaysia; his position with University X was his first employment in a private university. At the time of the interview, he had been working at University X for over a year. He was a department head, and was one of the key players in managing the use of technology in teaching and learning at the university. At the time of interview, he had also been teaching one of the compulsory Educational Technology courses for student teachers (using the distance learning format) for two consecutive semesters.

6.2.4.1.1 Overview of the Interview

In the interview, it was clear from the beginning that PSTE1 was enthusiastic about the use of technology. He was proud about the Learning Management System (LMS), a virtual learning environment platform used at University X. He claimed that the LMS has brought recognition to the university and it has added to the university's credentials as a pioneer in the local education scene to capitalise on E-learning technologies to extend opportunities for higher education in the country.

The interview began with PSTE1 describing how each teacher education programme at the university was designed and managed. He highlighted the university's achievement in meeting the demands of the Ministry of Education by offering the much-needed places for in-service teachers to enrol into seven teacher education programmes offered at the university, utilising 53 learning centres nationwide and their capacity for online delivery of instructional materials.

In the interview, PSTE1 described the content of their Educational Technology courses, which include a wide range of topics, in addition to introduction to commonly used technology hardware and software, and practical skills in how to use technology tools in a lesson. He showed a textbook module which was used in the course for all students and tutors.

When asked about the treatment of Constructivism in his course, he explained that Constructivism made up one part of the Learning Theories section of the teacher education programmes. PSTE1 believed that elements of Constructivism were adequately presented through use of online discussion boards on the LMS.

6.2.4.1.2 Analysis of the Interview

When the adapted TPCK framework was explained to PSTE1, he was confident that all components in the framework were adequately addressed in the Educational Technology courses offered at University X.

Based on the researcher's understanding of the input from PSTE1, data was mapped onto the conceptual tool to provide a graphic representation of PSTE1's narratives. The spaces in the adapted TPCK framework were marked when there was evidence indicated by PSTE1 in the interview to represent each knowledge type.

The analysis revealed that only four sections in the adapted TPCK framework can be identified in PSTE1's account of the treatment of teacher knowledge and Constructivism in University X's teacher education programme. The sections are technology knowledge; pedagogical knowledge, technological pedagogical knowledge, and constructivism within technological pedagogical knowledge.

a) Technology Knowledge: Based on PSTE1's description, this represented the main learning content for the courses.

b) Pedagogical Knowledge: Pedagogy is presented in the Learning Theories section of the courses, in that students are provided with reading materials about learning theories which are relevant to the integration of technology in teaching and learning.

c) Technological Pedagogical Knowledge: Their Educational Technology courses also addressed this type of knowledge, covering issues about how technology can be used within a pedagogical setting.

d) Constructivism within Technological Pedagogical Knowledge: PSTE1 pointed out that the Educational Technology courses also addressed issues about using Constructivist elements in using technology within a pedagogical setting. According to PSTE1, Constructivism was treated as one of the learning theories included in the course content and some of the learning units described how Constructivism can be included in a lesson using technology.

The interview also revealed that there were various teacher knowledge types depicted in the adapted TPCK framework which were not addressed in their Educational Technology courses. The sectors were:

a) Content Knowledge;

b) Pedagogical Content Knowledge;

c) Technological Pedagogical Content Knowledge;

d) Technological Content Knowledge; and

e) The overlaps between Constructivism and the TPCK framework, where the learning contents would include the integration of constructivist elements in Pedagogical Content Knowledge, Technological Pedagogical Content Knowledge, Technological Pedagogical Knowledge and Constructivism beyond Teacher Knowledge.

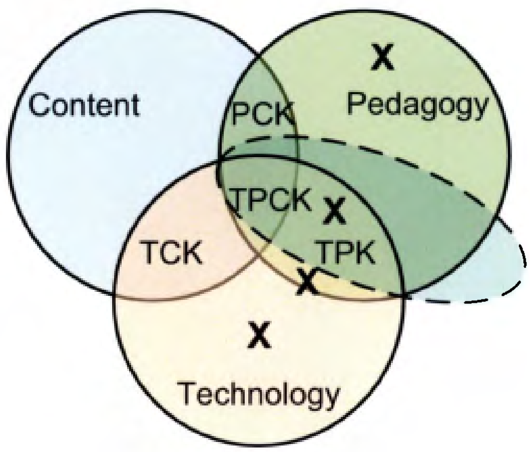

Figure 6.1: Mapping of PSTE1's Narrative onto the Adapted TPCK Framework

Figure 6.1 above presents a pattern in the data – the overlapping sectors between Content and Pedagogy are largely neglected in University X, based on PSTE1's account. These sectors represented spaces where Content, Pedagogy and Technology merged to form important subsets that represented integration of these knowledge types. Based on the interview and the lack of evidence to prove that these knowledge types were addressed, University X's Educational Technology courses did not address these types of knowledge that deal with the interplay of two or more components of teacher knowledge.

Significantly, this is a gap that may affect the way student teachers from University X interpret and teach using technology in the classroom. These neglected sectors are crucial to work out the interplay between content, pedagogy and technology because without adequate understanding about the dynamic inter-relationships between these teacher knowledge components, the teaching process may not be as effective as it could be.

In the interview, PSTE1 was extremely positive about the use of technology at his university, in spite of gaps in the teacher knowledge types identified in the teaching of Educational Technology courses. In the interview, when asked if he could provide evidence of practice to denote the use of technology, PSTE1 quickly argued that technology usage was sufficient, when he said, "Students are using the discussion forums online." He also added, "They can access the LMS anytime anywhere in the world." To show evidence of practice, PSTE1 also claimed he has provided adequate opportunities for his students to use technology during class time in the courses he teaches at the university. However, when describing how he typically implemented his instructional plan, he described how he used newspapers and music as tools to motivate students to "tap into their alpha-wave" and "to make them discuss topics of the lesson with other students." According to PSTE1, such instructional tasks were sufficient to teach their students how to learn about the uses of technology for teaching and learning. There was no clear mention about how he utilised technology-based activities in his courses.

Upon examining the treatment of Constructivism in their Educational Technology courses, PSTE1 believed Constructivism was the key theory used because he thought it to be a way to push students to be independent in their learning process. The graphic above indicates that Constructivism was barely addressed in the building of teacher knowledge in their Educational Technology courses. Though it was claimed that Constructivism was addressed in the way it could be used with Technology Knowledge and Pedagogical Knowledge, PSTE1 was not able to describe actual instructional instances where the teacher knowledge type was practised.

Based on PSTE1's narratives, this case study provides an example of the gap in literature reviewed in the previous chapters. Although technology was given a high profile and a great deal of attention in the educational model, as acquired from PSTE1's narratives, technology has not been integrated in any of the pedagogical or content knowledge aspects of the Educational Technology courses. In PSTE1's narratives, technology was taught as isolated constructs and there was an indication that their students were left to make their own connections between these constructs.

In the interview, when asked to expound on his own teaching practice, PSTE1 admitted that there were shortcomings in their Educational Technology courses. He, however, took on a defensive stance to explain how the blame for the shortcomings should be squarely placed on the writing process of their learning materials, in which he was not involved. He explained that the materials were designed and written in a short timeframe. He explained that there was a managerial top-down pressure on the academics to quickly prepare courses to offer the teacher education programmes at the time of the establishment of the university. He further claimed that the academics did not have time to review or amend any part of the course throughout the semesters that the Educational Technology courses were on offer. He also mentioned that there had been no curriculum review since the Educational Technology courses were first offered in 2001 up to the time of the interview. He reasoned that such a shortcoming affected the quality of the courses he currently taught.

Upon closer examination, there was an inconsistency in PSTE1's narratives. Although at the beginning of the interview he had claimed that the Educational Technology courses had not been updated since they were offered for the first time in 2001, further into the interview, he revealed that new topics had been added to the Educational Technology courses over time. He claimed that these additions had been proposed by his colleagues in the field of Educational Technology, who wanted to make the courses more relevant and current. When asked to elaborate on the actual syllabus and material writing process of the learning materials, the researcher was asked to meet with other teacher educators who he claimed "knew better about the history and workings of the Educational Technology courses" that they teach at University X.

Table 6.1:

Analysis Table for PSTE1's Narratives (Espoused Theories)

Knowledge Type	Evidence of Practice/Existence	Status
Content Knowledge	Textbook module's content	Present
Pedagogical Knowledge	Textbook module's content	Present
Technological Knowledge	Textbook module's content	Present
Pedagogical Content Knowledge	Textbook module's content	Present
Technological Content Knowledge	Textbook module's content	Present
Technological Pedagogical Knowledge	Textbook module's content	Present
Pedagogical Technological Content Knowledge	Textbook module's content	Present
Constructivism in CK	This is taught in a different course.	Present
Constructivism in TK	Textbook module's content	Present
Constructivism in PCK	Taught in another course	Present
Constructivism in TPK	Textbook module's content	Present
Constructivism in TPCK	Textbook module's content	Present
Constructivism	Taught in another course	Present

Table 6.2:

Analysis Table for PSTE1's Narratives (Theories-of-Action)

Knowledge Type	Evidence of Practice/Existence	Status
Content Knowledge	None presented	Nil
Pedagogical Knowledge	Topics on Learning Theories in textbook	Present
Technological Knowledge	Topics on ICT tools and functions in textbook	Present
Pedagogical Content Knowledge	None presented	Nil
Technological Content Knowledge	None presented	Nil
Technological Pedagogical Knowledge	Topics on Technology Integration in course textbook	Present
Pedagogical Technological Content Knowledge	None presented	Nil
Constructivism in CK	None presented	Nil
Constructivism in TK	None presented	Nil
Constructivism in PCK	None presented	Nil
Constructivism in TPK	Topics on Technology Integration in course textbook	Present
Constructivism in TPCK	None presented	Nil
Constructivism	None presented	Nil

In sum, although PSTE1 held optimistic views about the strengths and potential of technology, the idea of integrating technology, in the context of this research, TPCK, effectively did not seem to be reflected in his teaching and learning activities. Technology was mostly described at a superficial level, and though the university has been investing in state-of-the-art E-learning platforms, the approaches to teaching and learning still seemed to be prescriptive and of the behaviourist tradition, in that the value of academic success was very much focused on the attainment of high scores in formative and summative course assessments. When asked about the activities that exemplified Constructivism in instruction, PSTE1's examples did not indicate any pedagogical consideration of how elements of constructivist theory were used in the instructional development process; instead PSTE1 showed a one-dimensional use of technology tools to deliver media materials to the students. Much of the course placed emphasis on the assessments, which are conducted throughout each academic semester. Instead of providing as many pedagogical experiences and opportunities for exposure to the integration of Educational Technology in teaching and learning, the focus of teaching is on getting the student teachers to regurgitate learning materials in various assessment formats throughout the courses.

The interview provided a valuable insight into how interpretations about technology can get muddled in practice. In the interview, Educational Technology did not appear to be taught synchronously with learning content from a subject matter discipline, hence making technology seem like a separate entity in an instructional process, rather than a part of an integrated whole.

Most significantly, this interview has revealed hidden narratives about the interpretations of technology within a teacher education programme. Though technology knowledge was positively viewed in the interview as an important resource, it was not effectively integrated into the course. Teacher knowledge about Content and Pedagogy was dealt with in isolation, in each case. Constructivism was treated as a label for a teaching topic, an example of a learning theory. There was no evidence of it being applied or integrated with any part of the instructional delivery process. The interview also revealed that the uncovering of these hidden narratives is important to this research, because these narratives provide another dimension to the interpretations and insights into how teacher knowledge is developed at University X.

This interview analysis has proved that it was possible to reveal these unique and contextualised interpretations about the treatment of teacher knowledge development and Constructivism through the mapping of PSTE1's narratives using the adapted TPCK framework.

6.2.4.2 *Interview 2: Teacher Educator 2 at University X (PSTE2)*

The next interview was with another senior academic at University X (PSTE2). He was recommended for the interview by PSTE1, who had made earlier claims that PSTE2 had more experience in dealing with the curriculum design and materials development for all Educational Technology courses offered at University X since the university opened its doors for student enrolment in 2000.

PSTE2 was also a high-ranking administrator at University X. His interview took the shortest time compared to the rest. This was due to PSTE2's packed schedule as he was occupied with various university events. The interview was held at a conference venue, during coffee break, where he was delivering a keynote speech. His replies were mostly mono-syllabic and he appeared to be very guarded about explaining his role in teaching Educational Technology at the university. PSTE2 rushed through the questions in the interview and he appeared to evade answering questions that focused on the implementation side of the Educational Technology courses on offer.

From a design perspective, though this interview was done in a hurried manner, it was important to capture PSTE2's narratives because he was instrumental in designing the curriculum for teacher education at University X. During the interview, the researcher did ask if he could nominate other lecturers who are teaching Educational Technology courses at the present time. The only name PSTE2 suggested was PSTE1. At the time of interview, the session with PSTE1 has already been conducted. The researcher also offered to meet him at another time and place which may be more convenient for PSTE2 but he declined with reasons that his calendar was fully booked for the entire month.

6.2.4.2.1 *Overview of the Interview*

At the time of the interview, PSTE2 no longer actively taught any course, since he had been assigned to a prominent administrative position at the university. In the interview, he briefly described how he was involved in the pioneering work to design and select curriculum content for all teacher education courses at the university, including the Educational Technology courses offered to their in-service teachers. PSTE2 also provided estimated figures in an effort to demonstrate the success of University X's teacher education programme since its launch. He said the current annual enrolment in their teacher education programmes stood at 14,000 in-service teachers. He said the university plans to offer another 5,000 places for teachers to enrol within the next academic year.

6.2.4.2.2 Analysis of the Interview

When presented with the TPCK model, similar to the responses given by PSTE1, PSTE2 also claimed that their Educational Technology courses addressed all teacher knowledge types presented in the adapted TPCK framework.

Based on the researcher's understanding of the TPCK framework, in the interview, PSTE2 positioned the four main teacher knowledge types in the adapted TPCK framework in isolation from one another, instead of depicting them in a more interrelated and dynamic relationship. In the interview, PSTE2 briefly described how the content of Educational Technology was designed and taught in their teacher education courses. He explained that the Learning theories were put into all methodology courses for all the teacher education programmes they have on offer. This included Constructivism, which was treated as one of the learning theories important for understanding pedagogical approaches and practices in the classroom. He also revealed that the contents of their Educational Technology courses are written by subject matter experts from local public universities, and the learning materials produced are used as the standard course materials which are later taught (in face-to-face sessions) by tutors who are hired specifically to conduct face-to-face sessions with their distance learning students. This was contrary to PSTE1's account of the design of learning content, in that he claimed that PSTE2 was largely responsible for the scope, development and quality of instructional content for all of their Educational Technology courses.

PSTE2's narratives were mapped onto the adapted TPCK framework, as shown in **Figure 6.2**:

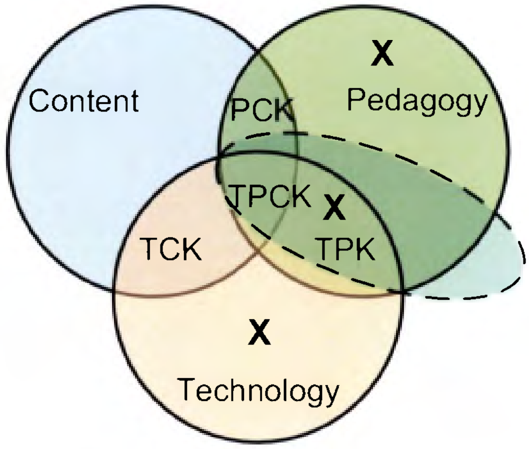

Figure 6.2: Mapping of PSTE2's Narrative onto the Adapted TPCK Framework

Figure 6.2 reveals how the development of teacher knowledge was perceived by PSTE2. All four elements were seen as separate entities, with the exception of Constructivism (as a learning theory) which is seen as part of the Pedagogical element of the TPCK framework. The interview also illustrated how the overlapping sectors on the framework are not addressed in their Educational Technology courses, and Constructivist elements are not integrated into the Content, Technology and Pedagogical sectors, as proposed by the adapted TPCK framework. This suggested that the importance of the relationships and interactions between these elements was not fully appreciated or, at least, not deliberately built and integrated into their Educational Technology curriculum. **Figure 6.2** also shows how the synergies between different teacher knowledge types were overlooked or neglected, as interpreted by PSTE2.

In the interview, PSTE2 defined Content Knowledge as learning content about Technology Knowledge, similar to PSTE1's descriptions in the previous interview.

Echoing similar sentiments to those expressed by PSTE1, PSTE2 also highlighted the importance of assessment as their main benchmark for successful completion of courses at University X. The preoccupation with assessment suggested the importance of grades and statistical figures to the university's management, because the numbers presented a quick impression about the competence of the university to produce graduates who are able to study and excel in their academic programmes. The interview with PSTE2 also alluded to importance placed on student achievement rates, which would serve as an important indicator of University X's commitment to teacher education and prove the university's credentials as a new higher education institution.

In the interview, PSTE2 described two types of constructivist principles in action; the first was "discovery learning," and the second was "experiential learning." He believed that these two types of constructivist principles were already integrated into the content of their Educational Technology courses. When asked to further elaborate, he revealed that Constructivist principles were not embedded in their courses. He said Constructivism as a theory was taught in these courses, but it is not necessarily embedded in the instructional design of the courses. He justified his claim by stating that Constructivist principles were "just another extension of the learning theories that were taught" in their Educational Technology courses.

When asked about challenges faced in the teaching of Educational Technology courses in general, and in the introduction of Constructivism in technology-enhanced lessons, he declined to respond. Instead, he recommended interviewing other course tutors who the university had hired to teach classroom sessions.

The researcher made an effort to follow up on PSTE2's suggestion. After the interview with him, the researcher went back to the university to collect names and contact details of the other course tutors, whom he mentioned earlier, could participate in the interviews. Unfortunately no contact details were given and PSTE1 reasoned that all their tutors were hired on one-semester basis; hence he did not think the tutors would be able to respond questions regarding the teaching of the Educational Technology courses, particularly since they were not directly involved in designing the curriculum for their Educational Technology courses. Their tutors were made up of lecturers from other universities around the country who were given pre-determined materials to facilitate the five-times a semester, face-to-face sessions with University X's students.

Table 6.3:

Analysis Table for PSTE2's Narratives (Espoused Theories)

Knowledge Type	Evidence of Practice/Existence	Status
Content Knowledge	**Textbook module's content**	Present

Pedagogical Knowledge	Textbook module's content	Present
Technological Knowledge	Textbook module's content	Present
Pedagogical Content Knowledge	Textbook module's content	Present
Technological Content Knowledge	Textbook module's content	Present
Technological Pedagogical Knowledge	Textbook module's content	Present
Pedagogical Technological Content Knowledge	Textbook module's content	Present
Constructivism in CK	This is taught in a different course.	Present
Constructivism in TK	Textbook module's content	Present
Constructivism in PCK	Taught in another course	Present
Constructivism in TPK	Textbook module's content	Present
Constructivism in TPCK	Textbook module's content	Present
Constructivism	Taught in another course	Present

Table 6.4:

Analysis Table for PSTE2's Narratives (Theories-of-Action)

Knowledge Type	**Evidence of Practice/Existence**	**Status**
Content Knowledge	None presented.	Nil
Pedagogical Knowledge	Topics covered in course textbooks	Present
Technological Knowledge	Topics covered in course textbooks	Present
Pedagogical Content Knowledge	None presented.	Nil
Technological Content Knowledge	None presented.	Nil
Technological Pedagogical Knowledge	Topics covered in course textbooks	Present
Pedagogical Technological Content Knowledge	None presented.	Nil
Constructivism in CK	None presented.	Nil
Constructivism in TK	None presented.	Nil
Constructivism in PCK	None presented.	Nil
Constructivism in TPK	None presented.	Nil

Constructivism in TPCK	None presented.	Nil
Constructivism	None presented.	Nil

In PSTE2's interview, there was also emphasis made on assessment and success rates, echoing similar sentiments expressed in PSTE1's interview. From the analysis, teacher knowledge types were not completely addressed in their courses, though in the interview PSTE2 was confident that University X's Educational Technology courses covered all types of teacher knowledge presented in the adapted TPCK framework. PSTE2 held a strong belief that the yardstick to measure success of their courses lay in the assessment design and implementation. In the interview, PSTE2 contradicted himself when he claimed that Constructivism was addressed in the courses, but further into the interview acknowledged that constructivist principles were not embedded in their assessment design. He also admitted that there were no practical teaching opportunities provided for their student teachers to translate theory into practice.

The interview with PSTE2 revealed more hidden narratives about how Educational Technology courses were taught at University X. There was evidently a lack of clarification of roles, as suggested in both interviews. Both narratives suggested that both teacher educators were unclear about their scope of responsibilities in terms of designing and teaching courses for Educational Technology in their teacher education programme. The narratives also showed inconsistencies in the way the teaching of Educational Technology courses were portrayed by both teacher educators.

6.2.4.3 Interview 3: Student teachers at University X (PSST1-3)

To gauge perceptions of student teachers at University X, the researcher contacted two contact points at the university. The contact points suggested meeting with the three student teachers who participated in this study. The initial communication with these students was done through the contact points.

The original plan was to interview these student teachers individually for approximately thirty minutes each. However, due to time and job constraints, the student teachers, who were working full-time as primary school teachers in a model technology school, were interviewed in a group of three. One of them was a school principal (ST1), and the other two student teachers work under her, both teaching English as a second language (ST2 and ST3). All three (ST1, ST2 and ST3) had more than five years of teaching experience prior to their enrolment into University X and were looking forward to finishing the final year of their study programme the following year.

There was a concern about the objectivity of these respondents as they were interviewed in a group, rather than individually. It was noted in this interview that two of these respondents gave guarded responses. Because of the dynamics of the group, in that one of the respondents was a senior, more authoritative member of their school, there was a view that the other two respondents might have decided to uphold a rather optimistic position throughout the interview, as a way to protect their power-distance relationship within the discourse. The researcher took steps to ask each respondent to answer every question individually though it was noticeable that their personal opinions increasingly surfaced as the interview went on.

6.2.4.3.1 *Overview of the Interview*

At the beginning of the interview, all three students expressed their satisfaction with the quality of the teacher education programme they were attending at University X. They were happy that they could meet with their course tutors four to five times per academic semester, for every course they were taking. Most of the time they study on their own at home and at work, and because their school was fully equipped with state-of-the-art technology infrastructure, they found it relatively easy to access their online learning system (the LMS) and to work on their learning materials from their workplace. This reaction was expected from these respondents because from the beginning of the interview, their responses were collectively geared toward showing the positive side of learning using technology at University X.

There was a notably high degree of satisfaction observed from their narratives. They strongly believed that technology was able to "upgrade (their) students' learning performances." Though at the time of interview, their school's E-learning system was not fully functional, the student teachers were still optimistic about the potential of using technology, because according to them:

> Students are happy in the classroom when teachers use the computer... students are able to teach others to use certain functionalities or tools on the computer... they feel proud about themselves... it boosts their self-confidence levels.

However. when asked to give their assessment of the Educational Technology courses they took at University X, all student teachers claimed that the courses did not provide any training to use technology, and that they have had to take their own initiative and resources to learn how to use technology in their teaching on their own accord.

6.2.4.3.2 *Analysis of the Interview*

Based on the input acquired during the interview, their espoused theories about teacher knowledge and Constructivism can be mapped onto the adapted TPCK framework as depicted in Figure 6.3 below.

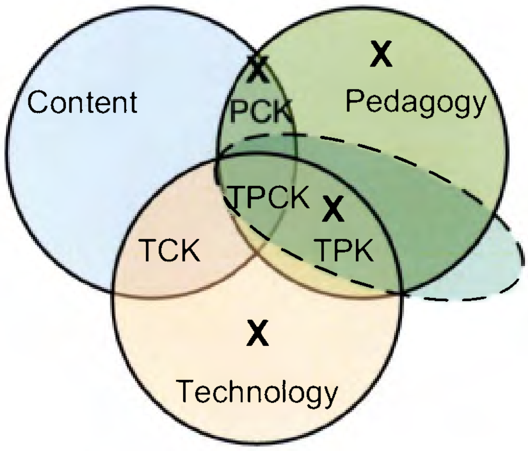

Figure 6.3: Mapping of PSST1-3's Narratives onto the Adapted TPCK Framework

The pattern presented above is similar to those acquired from interviews with their teacher educators (PSTE1 & PSTE2). Their narratives reveal that these teacher knowledge types addressed were pedagogy knowledge, technology knowledge, technological pedagogical knowledge, and pedagogical content knowledge.

a) Pedagogy Knowledge – they learnt about different learning theories in the Educational Technology courses.

b) Technology Knowledge – they learnt topics about various technology tools and how to use the tools.

c) Technological Pedagogical Knowledge – they learnt about how to use learning theories with technology, based on notes provided.

d) Pedagogical Content Knowledge – they claimed they learnt about how to integrate discipline knowledge with pedagogy, though later in the interview, they claimed that they had had to teach themselves how to integrate these two knowledge types into their course projects

Table 6.5 integrates both Espoused Theory and Theories-in-Action Analysis of Evidence tables which were used in the earlier narrative analyses.

Table 6.5:

Analysis Table for ST1-3's Narratives (Espoused Theories & Theories-in-Action)

Knowledge Type	Espoused Evidence	Status	Theories-in-Action Evidence	Status
CK	None presented.	Nil	None presented.	Nil
PK	None presented.	Nil	Not within Educational Technology courses.	Present
TK	Topics covered in Educational Technology courses.		Topics covered in Educational Technology courses.	Present
PCK	Content in course textbooks.		Through course projects.	Present
TCK	None presented	Nil	None presented	Nil
TPK	None presented	Nil	Content in Educational Technology textbooks.	Present
TPCK	None presented	Nil	None presented	Nil
C-in-CK	None presented	Nil	None presented	Nil
C-in-TK	None presented	Nil	None presented	Nil
C-in-PCK	None presented	Nil	None presented	Nil
C-in-TPK	None presented	Nil	None presented	Nil
C-in-TPCK	None presented	Nil	None presented	Nil
Constructivism	None presented	Nil	None presented	Nil

The student teachers' response revealed that they were taught about the relationships between content and pedagogy (Pedagogical Content Knowledge) in their Educational Technology courses. This was markedly different from the accounts from their teacher educators, who both failed to describe how they addressed Pedagogical Content Knowledge in their courses, justifying the neglect as lack of opportunity to include this in the current set up of the courses. Further into the interview, the student teachers revealed how they perceived that they learnt about pedagogical content knowledge through an example in a lesson. They described how one of the courses called "Prinsip Teknologi Pendidikan" (Educational Technology Principles) did not have very helpful learning materials, but because these student teachers already had their personal technology competencies, they were able to learn and internalise the content better. They found that materials from other resources (such as materials found online from other Educational Technology websites) were much better than the contents offered in the course, so the students complemented their learning process by supplementing their own reading resources on their own initiative. They picked up ideas and suggestions about how to integrate pedagogy and content through these external supplementary readings, and because they were on full-time teaching duty, they were able to experiment with the ideas they picked up from their learning materials in their instructional design and delivery processes. The student teachers later agreed that they learned about PCK when doing their course projects.

When asked about Constructivism, these student teachers unanimously claimed that they did not learn about Constructivism from the courses they took at University X. The students were confident that they were adequately trained in how to integrate the principles of Constructivism into their lessons because they attended training programmes offered by the Ministry of Education. Because Constructivism was highly regarded as the key learning theory to be used in a technology-enhanced classroom in the local Educational Technology circles, these student teachers admitted that they were able to use a significant amount of constructivist jargon to describe the way their lessons were designed and implemented. They attributed their knowledge about using Constructivism in their lessons to a virtual learning environment which was set up in their school (their school is part of a special national programme called "Smart School Programme" – see earlier notes). When asked to give examples of their use of Constructivism within a lesson, they described the following scenarios: use of critical thinking skills and creating authentic learning experiences.

a) Use of Critical thinking skills: Students present to their teachers proposals for study topics to be covered in a lesson. The teachers would then ask students to go to the Internet to look for relevant materials related to the proposed topics. Students are given materials (by the teachers) to compare and contrast. Consequently, the students are encouraged to discuss/explain their thoughts, using narratives and so forth, using the given materials.

b) Creating Authentic learning experiences: When they come into computer labs, students are usually able to do things on their own using their school's E-learning system, after receiving basic guidance from their teachers. The students are given the freedom to explore the learning packages which are readily available at their computer labs. Class tasks which involve the use of technology are considered as "authentic learning experiences" by these student teachers.

In the interview, the students expressed concerns about course assessments. They stated that their courses were geared toward achieving specific learning outcomes which were often in the form of summative assessments.

When asked to describe how Constructivism can be put into action in classroom instruction, the student teachers described it as "scaffolding instruction to help students connect one concept to another." PSST2 and PSST3 also claimed that "Constructivism encourages teachers to emphasise hands-on experiences, a useful strategy to help students remember what they are learning." Furthermore, the claims by PSST2 and PSST3 student teachers affirmed that the school's administration played a major role in creating a favourable learning environment to push students and teachers to use technology creatively and frequently in their classrooms.

When asked about their own learning experiences in understanding Constructivism through the learning materials provided by University X, they said that their learning exploration within the LMS was very controlled, because they felt they had to be very cautious when using University X's LMS, as they did not want to "mess things up" in the system. They also felt that the learning tasks in the Educational Technology courses were mainly designed to help them pass examinations, because they were aware that there was little opportunity to use technology using a Constructivist approach within the courses.

On reflection, there was a possibility of bias in the manner the responses were given during the interview. The responses given may not necessarily be attributed to a weakness in the application of learning theories in the curriculum, or in the structure of individual courses. There is a strong possibility that the inconsistencies recorded from their narratives stemmed from the structure of the researcher's survey instrument and also the approach taken when interviewing the respondents. The responses might have been given to match what they had thought the researcher would like to hear, or what they had thought to make them appear knowledgeable about jargon and concepts they may have not been familiar with that they did not want to admit.

6.2.4.3.3 Comparative Analysis of Narratives by Teacher Educators and Student Teachers from University X

The responses from both groups reveal discrepancies in the way teacher knowledge is addressed in the Educational Technology courses at University X.

In the teacher educators' narratives, both interviewees labelled Technology Knowledge as Content Knowledge. The classification of Technology Knowledge as Content Knowledge indicates a strong inclination to emphasise the acquisition of Technology Knowledge in the Educational Technology courses. Both teacher educators were also keen to claim that their courses addressed all teacher knowledge types presented in the adapted TPCK framework. However, upon closer analysis, it was clear that most of the teacher knowledge types addressed in their courses were those that did not overlap with other knowledge types presented in the adapted TPCK framework. Topics were taught in isolation and high dependence was placed on the learning resources which were made available in hard copy and online. It was also obvious that the synergies between the three main constructs of the TPCK framework are not dealt with sufficiently, at least in the way the narratives were offered during the interviews. The content of their Educational Technology courses appeared to focus on technology knowledge.

On the other hand, the student teachers' accounts made it was clear that they did not find that their Educational Technology courses provided adequate lessons, ideas and exposure for dealing with pedagogical content knowledge. Initially, they claimed that pedagogical content knowledge was addressed in their Educational Technology courses. However, when asked to explain further, the student teachers described how they used many external resources to supplement the learning materials they received from University X and they were also able to experiment with ideas they acquired from the accumulated readings with their own students in a real classroom setting. Their on-going classroom experiences added a bonus to their personal learning experiences, because these provided numerous opportunities for them to try their lesson designs with actual students.

In the interviews, both groups noted the importance of course assessment as the measure of success in the courses offered at University X, particularly the teacher educators. Consequently, the student teachers' focus in their learning processes became geared toward achieving the expected course outcomes. This was obvious from the interviews, in that the student teachers were wary about the grades they scored throughout the academic semesters.

When asked to describe how Constructivism was taught and learned, both teacher educators claimed that Constructivism was already included in the pedagogical aspect of their Educational Technology courses. They explained that Constructivism was taught as one of the learning theories to be considered for any methodological decisions, but constructivist elements which are integrated into a lesson, to match the scope of content, pedagogy and technology, are not addressed in these courses. However, when probed further to give examples of practice, they did not respond directly and did not offer evidence to consolidate their narratives. When asked if they could nominate other colleagues whom they regarded as more knowledgeable about the Educational Technology courses at their university, they failed to respond. Similarly, the student teachers expressed the same position about Constructivism in their courses. In the interview, they used popular jargon to illustrate their interpretations of Constructivism within a lesson, but most of their examples of use reflected a lack of understanding of the functions of Constructivism within instructional design and delivery. When asked to elaborate, they explained that they had learnt about Constructivism from other training courses and not from the Educational Technology courses at University X. The student teachers were quick to label their classroom learning activities as creative thinking and critical thinking; however, upon closer analysis of the example scenarios they described, the actual deployment of constructivist principles was poorly understood and misleading.

The experience from this interview has opened an interesting issue about the goal of good learning experience. To the respondents, the goal of good learning seemed to be the grades they score in a course. This also raised a question about the way the course objectives were structured. In the earlier interviews with the teacher educators, there was no clear indication about the approach taken to structure the course objectives of their Educational Technology courses. The narratives from both teacher educators seemed to emphasise their strength in using E-learning in their courses as the marker of success in their course design.

6.3 Summary

Data from these participants from University X reflected the gaps in interpreting how teacher knowledge was addressed in the teaching and learning of Educational Technology. This was illustrated in the narratives and could be seen through their descriptions of course scope, instructional tasks and learning content for their Educational Technology courses. Topics in their Educational Technology courses were mainly taught in isolation. Teacher knowledge types were addressed as a separate entity. There was a noticeable lack of opportunity and resources to teach students to combine two or more teacher knowledge types within a lesson. The dynamic relationships between content, pedagogy and technology were obviously avoided or neglected, revealing a lack of emphasis on using technology by effectively aligning it to the content and pedagogy available for the teacher. Their student teachers admitted to having to supplement their learning processes by finding and using external resources, a strategy they found useful to enrich their own comprehension and insight into using technology effectively in a classroom environment. Though this is a commonly accepted practice at higher education elsewhere, in Malaysia, many university students still depend on their course instructors to provide notes and resources. The culture of spoon-feeding students is widespread and difficult to tackle. Further discussion on this issue would warrant a focused study to document and analyse the roots of this unhealthy academic culture.

In the interviews, the students also realised the shortcomings of their Educational Technology courses. They reported that the Educational Technology syllabus limited their opportunity to using technology within an instructional design and delivery process. It is also important to note how course assessment plays a major role in dictating the teaching and learning processes in these Educational Technology courses. The student teachers became conscious of the emphasis on course assessment and they revealed how they have had to spend most of their learning time to achieve expected scores for each course task assigned to them in the courses. This disclosure reflects the inconsistencies in the way teacher knowledge is built through these Educational Technology courses because the learning content did not address the assimilation of technology use into the processes of pedagogical and content design and delivery. Consequently, there seemed to be a possibility that these student teachers might complete their professional training programme with inadequate exposure to and limited conception about the roles and functions of technology in the design of a lesson.

In terms of learning about Constructivism, both groups appeared unprepared to discuss what they understood about Constructivism. Their explanations about how to use Constructivism within a technology-enhanced lesson revealed a cursory level of knowledge about the learning theory. Their narratives suggested a noticeable inclination to use Constructivist Theory's jargon to label any classroom activity that uses any technology.

These interviews have illustrated an important scenario about the teaching and learning of Educational Technology at a university that delivers its instruction online: the respondents have bought into the hype about technology as an empowering tool for education. However, from the analysis, the narratives revealed that their teacher knowledge appeared to be treated at cursory level; and, there is little emphasis placed on building teaching competencies using technology.

Although in this case study, data was only acquired from the three interviews, it has revealed significant variations in how teacher knowledge and Constructivism are treated at University X. This chapter has proved that the research methodology chosen for this research was able to capture useable data using a research tool that has revealed significant findings about the context of teaching and learning within the teacher training environment at University X.

The findings also uncovered surprises about the treatment of Constructivism as a learning theory, within the context of teaching and learning Educational Technology. Narratives reflected a lack of investigation into the actual use of Constructivism in Educational Technology training. Constructivism was used superficially and was not properly integrated into the teaching and learning of technology, thus leaving both teacher educators and their student teachers only using Constructivism as a cover term to indicate any teaching and learning activity that used any form of technology tool, no matter how irrelevant or purposeless the tool was to the context of learning.

To investigate these research issues further, the next section presents findings from the second case study at University Y, to compare and contrast the conceptions and practices about teacher knowledge and Constructivism between the two teacher education programmes which participated in this pilot study.

Chapter 7: The Pilot Study – Part 2

7.1 Introduction

In the previous chapter, the first pilot study investigated issues regarding the treatment of Educational Technology within the context of a private university which offers teacher training courses using a distance learning format. Data from the study have shown evidence of contrasting perceptions about the teaching and learning of Educational Technology at University X.

In this chapter, the second part of the pilot study is presented. The second pilot was carried out at a public university, University Y, which is governed by a different set of institutional politics, philosophies and academic traditions than University X. It was decided that data from contrasting types of instructional delivery would provide a broad example of how teacher education programmes are offered in Malaysia. At the time of writing, there has not been any known study that looked at Teacher Knowledge issues at two universities that utilised different instructional delivery formats.

The following section presents data acquired from interviews with one teacher educator and two student teachers at University Y.

7.2 Analyses of Interviews

7.2.1 Interview 1: Teacher Educator 3 at University Y (PSTE3)

At the time of the interview, PSTE3 was holding a Senior Lecturer post. His academic background was not revealed in the interview. The only information he provided about himself was that he has been teaching Educational Technology courses at University Y for over twenty years. He was nominated to participate in this study by the researcher's contact point at the university.

7.2.1.1 Overview of the Interview

From the beginning, the tone of this interview was different from other interviews conducted for this pilot study. The session was largely dictated by PSTE3, the interviewee, who insisted he was more able to assess the researcher's personal philosophy about Education. He insisted on asking questions about the researcher's competence in researching issues about teacher education, even before he responded to any of the interview questions planned for the session. PSTE3 consistently emphasised his expertise in the Educational Technology domain throughout the interview, and subsequently described his many years of experience dealing with issues in Teacher Education. He repeatedly questioned the researcher's knowledge, experience and opinions about each question that was put forward to him. Like those at University X, this interview session was also not recorded because PSTE3 refused to give consent for any type of recording. The justification given at the time of interview was that PSTE3 has had flawed experiences with other students who had interviewed him for different studies, where he was cited out of context and his citations were printed in the media. Consequently, it is worth noting that PSTE3's persistence in controlling the scope and speed of the interview is reflected in the scope and depth of data acquired from this interview.

At the time of the interview, there were 37 students enrolled for each cohort in the Educational Technology programme at the Faculty of Education. At any one time in the academic year, there are four cohorts of students in the teacher education programme, all of which would be enrolled in courses in their own specialism. All of the teacher education students were enrolled for the Bachelor of Education degree, with a major in Multimedia. Upon graduation, the student teachers will be allowed to teach up to Form 3 at secondary school level (third year in high school, or Year 9 in school).

7.2.1.2 Analysis of the Interview

In the interview, when the intentions of this research were explained, PSTE3 demanded to know exactly the issues that the researcher was intending to examine. When graphically shown the types of teacher knowledge in the adapted TPCK framework, PSTE3 marked all spaces in the graphic to indicate that the teacher knowledge types were addressed adequately in their Educational Technology courses at University Y. At that point of the study, the research had not intended to use the TPCK framework graphic for interviewees to visually mark the spaces in which they perceived to be covered in their courses.

PSTE3's version of the analysis of how University Y addresses teacher education development can be seen in **Figure 7.1** below.

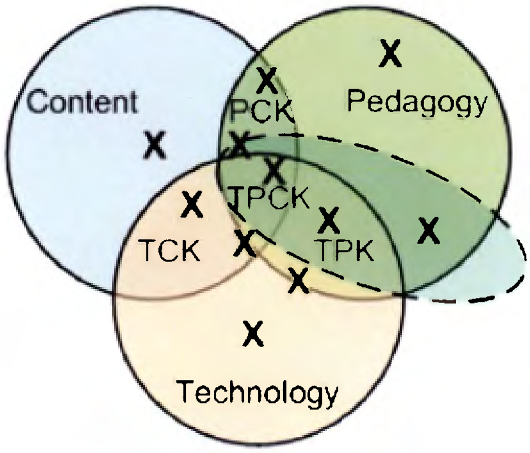

Figure 7.1: Mapping of PSTE3's Personal Reflection on Teacher Knowledge Development at University Y, onto the Adapted TPCK Framework

Figure 7.1 illustrates the spaces he marked during the interview. It represented TE3's personal reflection about his institution's strengths in the field of Educational Technology. When elaborating, he associated his personal competence as a teacher educator in an established academic organisation to the spaces in the adapted TPCK framework. In his descriptions, his narratives implied an idealistic position about the nature of Educational Technology courses he taught at University Y. TE3 did not think there were any issues about the way their teacher education programme approached the development of teacher knowledge, specifically in the field of Educational Technology.

When asked specifically about how teacher knowledge was addressed in his courses, he gave explanations of Content Knowledge, Pedagogical Knowledge and Technological Pedagogical Knowledge, with Constructivism.

a) Content Knowledge – PSTE3 directed the researcher to check the university website, which lists all the key course information, including a list of content topics covered for all courses on Educational Technology offered at University Y.

b) Pedagogical Knowledge – PSTE3 described teaching about learning theories, and how students are asked to illustrate their understanding about each learning theory in various course projects in their Educational Technology courses. In the interview, he showed the list of learning theories he covered in his course syllabus.

c) Technological Pedagogical Knowledge, with Constructivism – PSTE3 explained how he used Yahoo® groups as a pedagogical strategy to train his students to use technology within an educational context. He said that he used the online forum to highlight the main contents of his courses and also to send mass emails to notify everyone about any developments for the courses. Though an online medium was used in his courses, there was no elaboration or evidence that he had used any constructivist principles in handling the online forum.

Table 7.1:

Analysis Table for TE3's Narratives (Espoused Theories)

Knowledge Type	**Evidence of Practice/Existence**	**Status**
Content Knowledge	Course reading list	Present
Pedagogical Knowledge	Course reading list	Present
Technological Knowledge	Course reading list	Present
Pedagogical Content Knowledge	Course reading list	Present
Technological Content Knowledge	Course reading list	Present
Technological Pedagogical Knowledge	Course reading list	Present
Pedagogical Technological Content Knowledge	Course reading list	Present
Constructivism in CK	Course reading list	Present
Constructivism in TK	Course reading list	Present
Constructivism in PK	Course reading list	Present
Constructivism in PCK	Course reading list	Present
Constructivism in TPK	Course reading list	Present
Constructivism in TPCK	Course reading list	Present
Constructivism	Course reading list	Present

In the interview, PSTE3 said he believed that the courses at University Y recognised the importance of educational content. He explained that, in their Educational Technology curriculum, they had included adequate content to cover all important issues about Educational Technology, pedagogy and also the technical aspects of technology tools they recommend for use in school classrooms. PSTE3 claimed that "technology is used only to enhance the competencies of the human practice." His claim reflected a priority he perceived that had been given to content material in University Y's Educational Technology courses. He repeatedly stressed that technology was only to be perceived as a tool to enhance the learning process and that it should not be treated as an important focus in education.

Throughout the interview PSTE3 consistently put forward his own philosophy about technology being a "vehicle", and that "thinking is the goal for learning." When asked to describe actual learning activities that he has used in the class with the student teachers, he gave little clue about the tasks he implemented or designed. Instead, he kept describing the kinds of reading resources he always used for students' reading assignments. He justified this by claiming that the Educational Technology courses were designed as a "starting point by default, to help students think about their own learning process." During the interview, he also continually asked for the researcher's opinion and knowledge about the persons he believed to be important in the field of Educational Technology and Constructivism. He used every opportunity in the interview to pass judgment on the researcher's knowledge about the field, particularly when the researcher confessed to not knowing some of the reading materials he advocated as being seminal for any serious educational technologist.

PSTE3 became noticeably pleased when asked about his opinion on the treatment of Constructivism in the Educational Technology courses at the university. He spoke at length about Vygotsky's and Kuhn's philosophies on Constructivism, and emphasised how important they were to the field of education in general, for their forward-thinking views on the role of technology in the learning process. PSTE3 also said that Constructivist principles "enable teachers to be aware of content knowledge," and that "it is a curriculum process." When asked about specific teaching or learning processes used to exemplify the use of these philosophical thoughts in action, PSTE3 again reverted to talking about the contents of reading lists that he recommended for extra reading for students in his courses.

However, when asked if he could provide examples of the way he addressed the knowledge types in the adapted TPCK framework, PSTE3 did not provide evidence. Instead, he asked the researcher to read up the materials on his course reading lists.

When asked if there was any practical training session for the students to demonstrate their understanding of Constructivism, he explained that typically he would divide his class into small groups. Each group is assigned to work on one study topic in his course. The students were expected to find their own resources to interpret the assigned study topic. Later in the course, they would be asked to present results of their exploration to the class. He claimed that this was a useful pedagogical strategy because he perceived that students learn independently in the project, thus making them "experience Constructivism first hand" by working on their own.

From his years of teaching at University Y, PSTE3 revealed that he believed many academics and students alike were still in the dark about using Constructivism and also about the theory itself. He attributed this lack of understanding to the failure of lecturers to use Constructivism effectively in their instructional activities. He also claimed that the root of the problem was the lack of reading of good quality literature because he believed that many lecturers did not constantly seek to find out more about the field they are teaching and did not regularly update their knowledge and understanding in the field.

During this interview, one of PSTE3's postgraduate students accompanied the researcher in the session. PSTE3 took the opportunity of his student's presence to highlight the success of his own teaching of Constructivism to his postgraduate students. PSTE3 claimed that his postgraduate students were more mature in thought and experience, when compared to his undergraduate students. He believed that his postgraduate students were more able and competent in comprehending Constructivist principles in a teaching and learning situation. In the session, PSTE3 repeatedly attempted to challenge and compare the researcher's depth of understanding about Constructivism with that of his student. The presence of his own student in the room seemed to provide an unforeseen opportunity for him to establish and prove his "success story" in the teaching of Constructivism at University Y.

In retrospect, this interview with PSTE3 has provided a unique insight into a discourse about Educational Technology from a teacher educator's perspective. PSTE3's narratives, actions and input during the interview implied a defensive position. PSTE3 was also evading questions that he did not perceive as of great consequence in his courses.

PSTE3 has been teaching courses in the area for a very long time. It was interesting to uncover PSTE3's perceptions on integrating technology, which were centred on mastering the theoretical and philosophical aspects of learning. There was little mention of the use of technology in line with a pedagogical theory, for instance Constructivism, though in the interview, PSTE3 repeatedly stated how "thinking is the goal," and he thought that any technology tool used in any learning environment would only be a "vehicle to help thinking happen." PSTE3 appeared to be very concerned about the philosophical understanding of knowledge acquisition.

There were some contradictions in PSTE3's accounts during the interview. He appeared to acknowledge the uses of technology in the classroom, though he claimed that he did not emphasise on them in class. In the interview, PSTE3 did not include examples of how he addressed the other knowledge types in his own courses. There was a noticeable gap in PSTE3's narrative about providing guidance for his students. The Constructivism that he models to his students as his choice of instructional approach contradicted the core elements of Constructivism, which are collaboration and scaffolding instruction, which are so strongly advocated by the learning theory.

From the researcher's perspective, the mapping of PSTE3's narrative would be illustrated as in Figure 7.2 below.

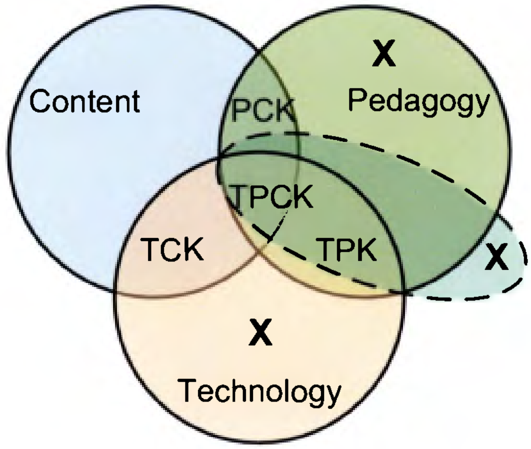

Figure 7.2: Mapping of PSTE3's Narrative onto the Adapted TPCK Framework, based on Evidence of use as Acquired from Narrative

The areas marked in **Figure 7.2** indicate the scope of the adapted TPCK framework that PSTE3 has described through evidence of actual use in his courses. These areas of knowledge are Technology, Pedagogical and Constructivism, beyond TPCK.

a) Technology Knowledge – PSTE3 mentioned that he sometimes used PowerPoint presentations in his class, but most of the time, students were asked to read up about the different technology tools available for teaching and learning. The students were expected to explore the tools of their own accord.

b) Pedagogical Knowledge – There was a list of learning theories that was used in the syllabus for his courses.

c) Constructivism, beyond TPCK – PSTE3 described extensively the place of Constructivism in his courses. He quoted many examples using seminal readings about the theory, and recommending them as key materials for anyone who wants to understand the use of the theory in education. He believed that Constructivism should be treated as a tool for learning, similar to his principles about the use of Technology in the classroom, because he believed learning does not depend on the existence of these components to make it work. However, there was no evidence of practice that addressed the integration of Constructivism with other components in the adapted TPCK framework.

It was not clear in the interview if PSTE3 addressed the development of Content Knowledge or any of the overlapping areas in his Educational Technology courses. During the interview, PSTE3 evaded all questions about the overlapping areas in the TPCK framework, though the areas marked by him (**Figure 7.2**) were categorised as "critical areas" for building teacher knowledge (Shulman, 1986; Mishra & Koehler, 2006).

Table 7.2:

Analysis Table for TE2's Narratives (Theories-of-Action) (Researcher's Reflection)

Knowledge Type	**Evidence of Practice/Existence**	**Status**
Content Knowledge	None presented	Nil
Pedagogical Knowledge	Topics on Learning Theories in syllabus	Present
Technological Knowledge	Topics on ICT tools and functions in syllabus	Present
Pedagogical Content Knowledge	None presented	Nil
Technological Content Knowledge	None presented	Nil
Technological Pedagogical Knowledge	None presented	Nil
Pedagogical Technological Content Knowledge	None presented	Nil
Constructivism in CK	None presented	Nil
Constructivism in TK	None presented	Nil
Constructivism in PK	None presented	Nil
Constructivism in PCK	None presented	Nil
Constructivism in TPK	None presented	Nil
Constructivism in TPCK	None presented	Nil
Constructivism	Course reading list	Present

At the end of the interview, PSTE3 cautioned the researcher about the reporting style of the interview session. He warned the researcher to read his recommended list of readings before attempting to dissect and analyse data from the interview, because he thought the researcher was not in any position to conduct any research in the field at all. He described how he made his own research students go through extensive reading materials and learn them by rote, before they are allowed to do any kind of field work for their theses. He also said that if the research was under his supervision, he would deem her unfit to conduct the interview, because he concluded that she was not competent enough about the field, and that the researcher did not illustrate great depth of knowledge about the issues raised in the interview. As the final parting word, PSTE3 told the researcher to write "intelligently" about the state of education in Malaysia. He cautioned the researcher to avoid highlighting or dwelling on potentially damaging aspects of this research as he felt it would bring embarrassment and shame to the universities that participated in the researcher's study (all of whom, he stressed, are already "connoisseurs of knowledge," for all the years they have been working as academics at the established institutions of higher learning in the country). Consequently he felt that Malaysian academics would not "look good" in the eyes of the British academics (who would be reading and examining this thesis).

The input from PSTE3 brought a unique angle to this research – in previous interviews with teacher educators at University X, though there were issues identified about addressing teaching knowledge developments, none of the teacher educators were as defensive or as hostile as PSTE3. The approach by PSTE3 in the interview suggested that there were other issues pertaining to the nature of his approach to teaching Educational Technology that he wanted to preserve from being disclosed at the interview. PSTE3 kept repeating that he believed "thinking is the goal" and technology tools and learning theories were only "vehicles" to make thinking happen. He strongly believed his pedagogical strategy to plunge students right into their projects by assigning them to work independently was an excellent example of Constructivism-in-action.

The interview with PSTE3 also raises an important issue about the ethical considerations of this research. In the interview, the respondent dominated the flow and tone of the interview. The researcher had to decide on how to adapt to the research atmosphere to ensure that the respondent would not feel threatened about the input he was expected to contribute to the research. The researcher allowed time for the respondent to complete every anecdote that he wanted to share, before going on with the rest of the interview. When the researcher found discrepancies in his input, the researcher waited for an appropriate time to ask for clarification. When the respondent replied with hostility, the researcher did not pursue for further clarification. This was a necessary strategy because the researcher did not want to aggravate the atmosphere of the interview which might cause the respondent to cease from participating.

Input from the interview has also highlighted another issue regarding the distinctions between subject knowledge and professional knowledge. This is an issue which was discussed in Oxford Review of Education by Seamus Hegarty (2000, pp. 451-465). The paper argues the nature of research on teaching, specifically on how "knowledge base underpins teaching." Hegarty believes that it is a complex research activity to separately examine how a teaching process works and develops because when teachers teach, they do not exclusively access their knowledge base only. The input from PSTE3 also suggested his standing on this perspective. He repeatedly mentioned how he believed that his goal in teaching was to make his students think. This statement suggested that PSTE3 engaged his subject matter knowledge (about Education and its related field) and also his professional knowledge (what he perceived he represented as a member of academia in the field of Education) and perhaps many more different layers of other classifications of knowledge (such as beliefs about the subject, pedagogical content knowledge and so forth). The interview has provided a new perspective to the scope of the research. Further discussion on this issue will be detailed in the concluding chapter of this study.

Analysis of the views of his students, as presented in the following section makes for an interesting study in contrast.

7.2.2 Interview 2: Student teachers at University Y (PSST4 & PSST5)

For the student teacher interview, two undergraduates (ST4 and ST5) from University Y came to the interview. Both already have more than five years' teaching experience at primary school level. Initially, four students signed up to come for the interview, but only two attended. The interview started with ST4 first, and midway through the interview, ST5 joined in. Consequently, the interview was done simultaneously with both participants. The students opted not to provide consent for audio or video recording of the session. They justified this by saying that they did not want to "get into trouble" with their lecturers.

The students were interviewed simultaneously in a group interview. This decision was made based on the student teachers' request. The reason they gave was that they were attending the same programme and they felt more comfortable responding to the interview questions when their classmate was around. The presence of their peer in the same interview was seen as a way for the students to calibrate their responses. The students were suggested as participants in the pilot study by the researcher's contact point at the university. These were the only two student teachers who turned up for the interview. It would have been ideal to interview them individually. However, the students insisted that they had a packed class schedule and it would serve them better if the interview with them was done simultaneously. The group interview format was not part of the original plan for the interview. The researcher was also aware that there was also a possibility that such pairing during an interview would affect the nature of their responses. Where possible, the questions in the interview were asked one at a time, to one interviewee at a time. It was difficult to convince the students to adhere to the planned format of interview because they were persistent about the time they were willing to spend to be interviewed. The researcher was wary of the fact that further persuasion to conduct the interview individually might result in not having any student teacher at all for the interview.

7.2.2.1 Overview of the Interview

In the introductory session, both students described themselves as experienced technology users. Before enrolling into University Y, they were both class teachers at their respective schools, and they held posts as technology coordinators for the subjects they taught. As teachers, they have used government-produced materials in their primary school classes and so they were very aware of the classroom-level issues and challenges faced by teachers regarding the use of Educational Technology.

At the beginning of the interview, the students explained how they were required to complete two types of courses in Information Technology as part of the teacher training curriculum: Animation 2D & 3D, and Audiovisual & Multimedia Courseware Development. They both disclosed that the emphasis of these courses was largely placed on developing technical skills in using specific technology tools. Their coursework was mostly about producing multimedia-embedded projects.

7.2.2.2 Analysis of the Interview

When narratives from the interview were mapped onto the adapted TPCK framework, the pattern of data was depicted in Figure 7.3 below.

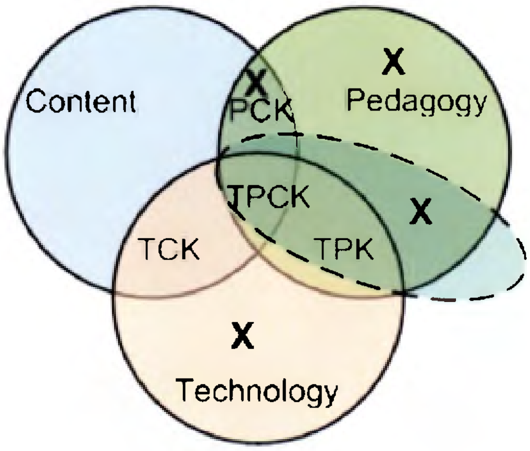

Figure 7.3: Mapping of PSST4-5's Narratives onto the Adapted TPCK Framework

At first glance, the graphic above is remarkably similar to the one produced from the interview with PSST1-3 at University X. PSST4 and PSST5 claimed that Content, Pedagogy, Technology and Constructivism were covered separately, with the exception of Pedagogical Content knowledge. They described how the courses they took at University Y normally focused on the content area of the courses. The areas marked in **Figure 7.3** represent Content Knowledge, Pedagogical Knowledge, Technology Knowledge, Pedagogical Content Knowledge, and Constructivism within Pedagogical Knowledge.

a) Content Knowledge – this was identified by the students - both said it referred to "Technology Knowledge," because it is the core of all of their Educational Technology.

b) Pedagogical Knowledge – they claimed they learnt a set of learning theories in each Educational Technology course they enrolled in at the university.

c) Technology Knowledge – they claimed because they are learning about Educational Technology, learning about "Technology Knowledge" is a given.

d) Pedagogical Content Knowledge – they claimed they have had to design lesson plans and multimedia resources to show that they were able to infuse Content knowledge and Pedagogical Knowledge coherently into a lesson that uses technology tools.

e) Constructivism within Pedagogical Knowledge – they claimed Constructivism was taught to them as part of the learning theories topic in their Educational Technology courses.

They explained that the components identified in the TPCK framework were usually taught separately, without much integration. They claimed that most of the teacher education courses they take at University Y focus on the theoretical aspects of learning. Their course assessments were usually designed to test the students' memory and recall about the theories they learnt in class, and consequently the students would normally focus on memorising key characteristics of the theories, rather than spending much time or effort in internalising the theories into actual practice.

During the interview, ST4 and ST5 also expressed the opinion the workload for all of their Educational Technology courses had been too much for them to handle, leaving them very little time to digest the content of learning materials assigned to them. Their focus for every academic semester has mainly been "getting through the courses, without much room to internalise the contents effectively." They explained how they have to juggle more than twenty credit hours per week every academic semester, and they have had to resort to memorising selected learning materials to pass their examinations.

Table 7.3:

Analysis Table for PSST4-5's Narratives (Espoused Theories)

Knowledge Type	Evidence of Practice/Existence	Status
Content Knowledge	They identified Technology Knowledge as Content Knowledge	Present
Pedagogical Knowledge	Topics on Learning Theories in syllabus	Present
Technological Knowledge	Technical knowledge learned as content of the course	Present
Pedagogical Content Knowledge	Course assignments indicated its use	Present
Technological Content Knowledge	None presented	Nil
Technological Pedagogical Knowledge	None presented	Nil
Pedagogical Technological Content Knowledge	None presented	Nil
Constructivism in CK	None presented	Nil
Constructivism in TK	None presented	Nil
Constructivism in PK	Topics in Learning Theories in syllabus	Present
Constructivism in PCK	None presented	Nil
Constructivism in TPK	None presented	Nil
Constructivism in TPCK	None presented	Nil
Constructivism	None presented	Nil

These student teachers also reported that their Educational Technology courses were focused mainly on the technical aspects of ICT tools. An example they gave was that their Educational Technology courses mainly dealt with mastering specific software tools introduced in a course. Their projects and assignments would normally require them to produce work using the software tools, and much of their effort would be spent learning how to use the assigned ICT tools to produce projects to meet their teacher educators' expectations.

When asked to reflect on their own experiences as school teachers, both students described that they personally saw how many of their own colleagues perceived the use of ICT in education as a "liability." In the teacher training programmes, they both agreed that they did not have ample time to learn how to design lessons effectively using technology, or to infuse constructivist principles into their lessons.

They also felt that honing their technical skills in the teacher education programme at University Y will earn them recognition in their school (as a "technology ace"), but they realised that the technical skills will not inform their practice adequately to help them become effective teachers.

On the treatment of Constructivism in the Educational Technology courses at University Y, they quickly discredited any use of the constructivist principles, and ST4 said:

> The scaffolding of instructional activities takes too long to design, and it does not help complete the syllabus.

They described how schools that they were personally familiar with did not emphasise the use of any learning theory. They claimed that the schools would rather put their effort into completing the subject syllabus on time, to help students pass national examinations, rather than dwelling on the types of learning theories to choose for each lesson. Both student teachers also revealed that in schools, teachers would not be bothered about applying methodological or pedagogical aspects when using technology, so the lack of emphasis in their Educational Technology courses at University Y did not bother them. One of them said:

> In the real world, teachers find it difficult to find time to embed technology into their lessons, because the setup for any technology integrated lesson would take too much time and effort, and consequently the majority of teachers would ignore or evade the use of technology altogether. (ST4)

Both student teachers gave a few examples of how they were taught about constructivist principles. In a typical course, their teacher educator would assign titles or topics to the student teachers. The students were then given parameters of the assignment (e.g. timeframe, scope of content and word length of project write-up). The student teachers were consequently left to "explore" the assigned topics on their own. They would eventually produce their personal version of the topic content, based on what they thought the lecturer expected from their work. This disclosure confirms how their teacher knowledge was being treated by their teacher educators. This aspect of learning was not revealed in the interview with TE3. The input was important for this research because it uncovered students' perceptions of how pedagogical strategies were put into action by their teacher educators at the university.

ST4 and ST5 also talked about their anxiety about learning at the university. They already had experience teaching at primary school level and it was the first time for them to study at tertiary level. They felt that the pedagogical approach used in their courses seemed intimidating. They had struggled to understand and to meet the expectations of their course instructors. Based on the conversation with these students, most of the time, these students were left to their own devices to grasp the content of their courses, with minimal or limited help or facilitation from their teacher educators. When further probed, it appeared that the version of Constructivist principles used in their courses was sketchy. What was even more worrying is that; the term "explore" appeared to be frivolously used under the guise of Constructivist principles, to urge students to find learning resources on their own, without guided phases or scaffolded instructions built into the instructional strategy to support the attainment of learning outcomes. This was consistent with current literature reviewed earlier in this study, which indicated a strong tendency to use a blanket terminology and to describe any technology-infused activities as being "constructivist-oriented."

ST4 and ST5 also talked about the workload of their courses. They typically enrolled in courses worth more than twenty credit hours per week. They found it hard to find ample time to work on their coursework. Consequently, they did not find sufficient time to be creative in the work they produced. When these student teachers were shown the types of knowledge identified in the adapted TPCK framework, specifically the overlapping areas of teacher knowledge, they immediately recognised the importance of the elements for building all components of teacher knowledge. However, they expressed scepticism about how much time and effort they would be able to spend to enable them to learn teacher knowledge sufficiently, on top of their current course workload.

In the interview, it was observable that the most important thing in the minds of both student teachers was to pass their course assessments. They appeared not too concerned about internalising pedagogical aspects of using Educational Technology. The students said that time constraints and pressure to pass the course provoked their anxiety, thus compelling them to ignore any task that would require them to make extra effort to internalise concepts and theories about learning. They revealed their normal practice was to concentrate their effort on memorising content that would be directly assessed in their course assessments.

The students also spoke about the incongruence between their expectations of the teacher education programme as a whole, and what appeared to be the expectations of their teacher educators. The students believed their teacher educators were unaware of the current scenario in actual classrooms in Malaysian schools, where technology was not used as regularly and extensively as suggested by the local media or by technology enthusiasts in academic circles. They also perceived that their teacher educators were unaware of the tendency to superficialy label any technology-infused classroom activities as Constructivist-oriented activities. Being experienced teachers, they said they knew what they were learning about Educational Technology in their courses would not be completely utilised when they returned to the classroom scene.

In sum, these student teachers appeared to be disillusioned by the promise of technology, despite the hype about using technology in education being discussed in largely academic circles in the country.

7.3 Comparative Analysis of Data

The interviews revealed incongruence in the way teacher knowledge and Constructivism were talked about by TE3 and ST4&5 in University Y. Though all belonging to the same learning environment, they did not appear to share similar perspectives or expectations about the treatment of teacher knowledge or Constructivism in their Educational Technology courses. TE3 claimed that all teacher knowledge types in the TPCK framework were addressed sufficiently in all Educational Technology courses at the university. However, from his students' accounts, it was doubtful if all the knowledge types were actually addressed in their courses. The students also felt their courses placed considerable weight on learning about various theories, but there was limited opportunity to learn how to translate them into action. They did not feel the knowledge they needed about teaching was sufficiently addressed in the courses. The student teachers were predominantly concerned about the burden of their course workload. The students were mainly aiming to complete their teacher training programmes by just "getting by." Based on what they revealed during the interview, the student teachers were not inclined to internalise content presented in their courses.

The student teachers also believed that there was a wide gap between the expectations of their lecturers about the use of technology and the reality of using technology in the classroom. While TE3 tried to be optimistic and confident about the quality of instruction that they provide at University Y, his student teachers perceived that the expectations of the Educational Technology courses were very much focused on producing multimedia projects and they did not emphasise the pedagogical value of using technology in the context of subject matter content.

The narratives from both TE3 and the student teachers revealed discrepancies in the way teacher knowledge is perceived and treated by each group. Different values were attached to the concept of teacher knowledge and Constructivism in the context of their teaching and learning environment. More importantly, the input from TE3 appeared more idealistic (with a heavy emphasis on reading selected literature), while his students perceived a lack of emphasis in integrating pedagogical and content knowledge with the use of technology.

The students also described the lack of congruence between the knowledge they were learning at the university and the knowledge they needed in order to teach using technology in school classrooms.

There was also incongruence in the treatment of Constructivism when the two narratives were compared. TE3 implied an intense focus on training the students using seminal literature in his courses. Though he stressed that thinking was the goal in all his courses, the students reported that they were tested on their memory of their learning content. Though the intentions of their teacher educator appeared to be Constructivist-oriented, in that TE3 wanted to train these students to become independent and able to make sense of their own learning experience, the students found it very hard to cope with the demands and expectations of their courses. Constructivism was essentially treated as textbook knowledge by the student teachers. They did not find ample opportunity to practise the constructivist elements within their learning process. Based on their narratives in the interview, the students' understanding about the Constructivist theory appeared shallow. The student teachers claimed there was a distinct lack of scaffolded instruction in their learning process, which consequently left them with very limited opportunity to learn about constructivist principles effectively in teaching and learning.

From the perspective of the student teachers, their only motivation to read the reading materials was to pass the final examinations. Most of their reading texts were in English and, in the interview, the students had also revealed their struggle to understand the reading materials, due to their low proficiency in English. The students claimed that the weight of their course workload and the uphill struggle to comprehend the reading materials made it almost impossible for them to internalise the knowledge from these Educational Technology courses.

The analysis of data acquired from these interviews revealed unique aspects about teaching and learning Educational Technology from both respondent groups at University Y. Though TE3 was optimistic about the value of the courses he taught, his student teachers did not find the overlap between content, pedagogy and technology knowledge was addressed in their Educational Technology courses. Instead, they found that in their courses' emphasis was mainly placed on mastering technical skills to produce multimedia resources. In addition, students were expected to "explore independently" and pass course examinations as benchmarks of learning success in the teacher education programme.

7.4 Discussion

Relating this case study to the study presented in the previous chapter has provided useful insights into the way teacher knowledge is addressed and handled. Use of the adapted TPCK framework enabled the analysis of each learning environment because the framework provided a language to describe and acquire the narratives from both groups of participants. It is interesting that the perceptions of teacher knowledge were similar at both universities, given the distinctly different ways Educational Technology courses are designed and delivered at the two model settings chosen for this study. One similarity that stands out from all narratives from both universities is that teacher knowledge constructs were dealt with at cursory level.

Most importantly, there was a distinct lack of emphasis on the integration of knowledge between content, pedagogy and technology. It also revealed that these teacher knowledge types were presented as separate entities, instead of being part of a whole teacher knowledge system.

Similarly, as anticipated from previous literature review chapters about the position of Constructivism in the classroom, Constructivism as a learning theory is treated superficially. Though the participants in the pilot study spoke highly about the potential of constructivist elements in technology-assisted teaching, they were not convincing when asked to detail specific teaching and learning events that would illustrate the use of Constructivism in their instructional delivery. This is an important finding for this piece of research, because these narratives have provided evidence about the lack of congruence between conceptions and the practice of these teacher educators and their student teachers, in the way they deal with teacher knowledge development and principles of Constructivism in Educational Technology. From both studies, it appears that even though the universities used different instructional delivery modes, their approaches in handling the development of teacher knowledge in their teacher education programme are alarmingly superficial and comparable. In addition, both case studies illustrate a heavy emphasis on course assessment, without much evidence of addressing the quality of instructional content or delivery at both universities.

The pilot study has demonstrated that the adapted TPCK framework has provided a functional language to describe how teacher knowledge and Constructivism were dealt with by both participant groups. The varying perspectives recorded from both case studies are consistent with findings which have been reported in previous studies in the field. Some previous studies have employed quantitative methodology to identify the effectiveness of using Educational Technology in the classroom. The findings illustrated a rather cursory use of technology by student teachers. This research has taken one step further in that its pilot study has demonstrated how comparable narratives from both groups (student teachers and their teacher educators) were in perceiving what they taught and learned. The TPCK framework has enabled the process of unearthing aspects about teaching and learning from these two groups, which were unanticipated from this study.

The narratives illustrated a development of thoughts of the respondents which were captured through use of semi-structured interviews. If a quantitative approach was used instead, it would have been more challenging to gauge the various instances of reactions in the words of the respondents as clearly as those captured through these semi-structured interviews.

The study was designed to look at both the espoused theories and theories-of-action of both groups (teacher educators and their students), to understand their professional uses of Educational Technology. No classes were in session at either university, making it impossible to conduct any classroom observations that would be useful to obtain evidence of theories-of-action.

7.5 Summary

This chapter presented findings from University Y where one teacher educator and two student teachers were interviewed. The analysis of data revealed the nature of the instances of teaching and learning of Educational Technology at this university tended to emphasise the development of Technology Knowledge. None of the teacher educators or student teachers in the pilot study was willing to provide evidence of practice, though the researcher asked for some examples in the form of student projects and course syllabuses. Hence, in the next stage of the research, classroom observations are planned, to capture the theories-in-action, and to understand how the espoused theories are played out in actual lessons. Classroom artefacts are collected and analysed in the main study to encapsulate the conceptions about teacher knowledge by teacher educators and their students.

Chapter 8: Main Study - Case 1

8.1 Introduction

Findings presented in the Pilot Study chapters have displayed incongruence between the beliefs of teacher educators and their student teachers. However, there was no notable difference in the way the two universities addressed teacher knowledge in their teacher training programmes although they employed different instructional delivery formats. Consequently, the main study concentrates on exploring the teaching and learning process in greater depth but with a narrower focus. This will involve a more detailed study of the development of teacher knowledge within a single university learning environment, irrespective of the instructional delivery format.

As described in the Methodology chapter, the initial plan was to acquire data from interviews, class artefacts and class observations. These types of data were expected to provide sufficient information about personal conceptions and classroom actions and communications. In the pilot study, the researcher was only able to acquire data through unrecorded interviews. Permission was not granted to obtain any data from other sources at Universities X and Y. For the main study, the research site was University Z. The selection was made based on the availability of the researcher's contact point at University Z to assist in inviting participants for the study.

The approach in the pilot study was originally to compare influences of instructional delivery formats on the way teaching and learning of Educational Technology at Universities X and Y are conceived by teacher educators and their students. The findings did not suggest sufficiently dissimilar features; consequently, in this main study, the methodological approach is focused on acquiring data about the relationship between rhetoric and practice in order to understand this issue in greater depth.

Drawing from the analysis from the pilot study, the main study explored the congruence between espoused theories *and* theories-in-action among participants, particularly in the way they perceive teacher knowledge and Constructivism as they are conceptualised and implemented in the teaching and learning of Educational

Technology courses at the university. Thus the main study contributed to solutions to these research questions:

1. What are the espoused theories and theories-in-action of teacher educators and student teachers that reflect their teaching and learning of Educational Technology courses?

2. What are their interpretations of Constructivism in their teaching and learning of Educational Technology?

Due to the length and depth of discussions necessary, discussion on the Main Study was divided into three chapters. Each chapter provides a systematic account of how data were acquired, analysed and associated with the goals of the overall research for one course within this institution. A chapter on the synthesis of findings follows to consolidate analyses of the three case studies, in relation to key issues and research patterns inferred from previously reviewed literature.

8.2 About the Main Study

The main study was conducted in early 2007 at a public university in Malaysia (University Z). It offered teacher education programmes to in-service and pre-service teachers in the country. Its four-year residential teacher education programme used a similar format to the second university presented in the pilot study phase, University Y. The students chose to specialise in one field of study from a range of available majors, such as Early Childhood Education, Religious Education, History, Geography, Chemistry and the Teaching of English as a Second Language. Though the teacher education programme did not use any dedicated E-learning platform to deliver its instructional content, each Educational Technology course observed for this main study has used a range of online learning technologies.

Three case studies were conducted to represent three different Educational Technology courses which were being taught in one academic semester at University Z. The selection of courses was influenced by the Head of Department, who gave permission to the researcher to conduct the main study at its Faculty of Education.

The majority of interview data acquired was in Malay language, as most of the interviewees were more comfortable expressing themselves in their first language.

There were also a number of mixed Malay-English expressions captured in the interviews and class observations. Class artefacts were all presented in Malay. Considerable care has been taken to preserve the content of each transcription. Each translation used in this chapter has been verified with a multilingual user of both Malay and English.

The following table details the types of data collected for each case study. As explained in the Methodology chapter, these data sources provided a valuable amount for analysis. The types of data ranged from oral narratives, observation notes and physical class artefacts.

Of the three case studies, only Case Study 3 is an incomplete set. The Head of Department was the teacher educator in Case Study 3. Permission was not granted by the Head of Department to interview target participants; hence, there was no data to represent the espoused theories of both teacher educator and student teachers in the third case group (see italicised items in **Table 8.1**). However, to compensate, the assignment descriptors which were provided by the Head of Department were used to represent the espoused theory of the teacher educator.

Three teacher educators were contacted via email before the study began. All three respondents agreed to participate in this study. They were teaching Educational Technology courses to different student cohorts at the time of the study. Based on the experience from the pilot study, the researcher took extra effort to explain the purpose of the study to all teacher educators before each interview began. The cautionary step was necessary to avoid any form of antagonism from the participants which might create a setback during the data collection process.

Table 8.1:

Breakdown of data sources and types acquired for main study at University Z

Data Source	Data type	Evidence for
	Case Study 1	
Teacher educator	Interview	Espoused theory
Student teacher 1	Interview	Espoused theory
Student teacher 2	Interview	Espoused theory

Class session	Observation notes	Theories in action
Student works	Class artefacts	Theories in action
Case Study 2		
Teacher educator	Interview	Espoused theory
Student teacher 1	Interview	Espoused theory
Student teacher 2	Interview	Espoused theory
Student teacher 3	Interview	Espoused theory
Class session	Observation notes	Theories in action
Student works	Class artefacts	Theories in action
Case Study 3		
*Teacher educator**	*Interview**	*Espoused theory**
*Student teacher 1**	*Interview**	*Espoused theory**
*Student teacher 2**	*Interview**	*Espoused theory**
Assignment Descriptors	Class artefacts	Espoused theory
Class session	Observation notes	Theories in action
Student works	Class artefacts	Theories in action

*These items had to be abandoned in the data collection phase because permission was not granted.

The student teachers were nominated by the teacher educators. All students were approached during the study and were briefed about the requirements of the study. All respondents were advised about their rights and all items in the Informed Consent Form were clarified.

In the following sections, data from the first case study are presented, analysed and discussed. The rest of the case studies are presented in the following chapters.

8.3 Case Study 1

There are four types of data acquired for Case 1 – the teacher educator interview, student teacher interviews, class observation, and classroom artefacts. The class artefacts were made up of student projects which were selected by their respective teacher educators to indicate the best, average and lowest performers in the observed Educational Technology course. At the time of data collection, it is not clear if consent was sought from the students when their class projects were given to the researcher. Copies of the artefacts were posted to the researcher after the semester was over.

8.3.1 Teacher Educator Interview

The first teacher educator (MSTE1) had been working as a lecturer at University Z for approximately ten years. His academic qualifications and research interests were mainly within the domain of Islamic Education. He had two years' experience teaching in a school, and he pursued his Master's degree in the UK soon after he joined University Z, where he took courses in *Sociology in Education*. While abroad, he was introduced to the idea of incorporating technology into education, and when he came back to resume his job as a teacher educator, he initiated the very first educational technology course for Islamic Education majors at the University's Faculty of Islamic Studies. The course was first offered as an elective, but when student feedback about the course was overwhelmingly positive, the faculty decided to make it a compulsory course for all Islamic Education majors. MSTE1 also described how elated he was when he found out that his students successfully found jobs directly related to the use of educational technology in schools and polytechnics in the country when they left the university. In the interview, he praised his students' success, saying such things as "[their] success [in using educational technology] has lessened the public image of Islamic Education graduates who were almost always known to be only fluent in Islamic Education and nothing else beyond that."

When asked to rate his general ICT proficiency, MSTE1 stated that he would position himself as "9 out of 10", because he felt he was proficient in many technology applications. However, he duly recognised the fact that "technology is rapidly changing" and that he had room to "learn more things from time to time." MSTE1 said, "It [the rating] is still relative, because the world of technology is still expanding, becoming more advanced. For the current [technologies], I think it's a nine. We cannot claim we know all the new ones [technologies], right?"

8.3.1.1 Analysis of the Interview

Preliminary analysis points to similarities between findings in this first interview and those in the pilot study, which was conducted in the previous year in two other teacher education programmes. In the interview, when MSTE1 was shown the TPCK framework as the working model for the research, he explained his take on his approach addressing the development of teacher knowledge in his course:

> ...Content, Technology, Pedagogy.... we cover it all... In terms of Pedagogy, if we look at Instructional Design, it's automatic... it's already covered....So the content must be there... okay... How we approach the content, how we adapt the content, using the instructional design...

This comment was the only time during the interview when MSTE1 described his approach to addressing teacher knowledge development in his course. In the interview, MSTE1 asserted that he had addressed all seven components of the TPCK framework in his course. He associated Instructional Design with the concept of Pedagogical Knowledge, assuming that it was "automatic" that pedagogical constructs were addressed in his course because he had already "looked at Instructional Design." MSTE1 added: "There's a perspective about us having to change the way we teach because we use technology... [I think] students are the ones using the computer... [therefore] they are capable...they are capable [of doing the changes]."

In the interview, there was no clarification about the way he addressed Content Knowledge. He seemed to have assumed that Content Knowledge was addressed because "content must be there." This is evidence of how Content Knowledge was misinterpreted in the interview – MSTE1 assumed that because he was teaching "something" in the Educational Technology course, this was sufficient to demonstrate that he had already addressed Content Knowledge. Fgure 8.1 below is a representation of MSTE1's espoused theories about the way he dealt with teacher knowledge elements in his Educational Technology course.

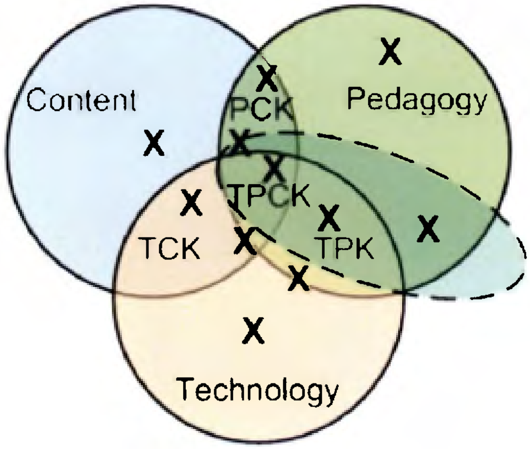

Figure 8.1: Mapping of MSTE1's Narratives onto the Adapted TPCK Framework (Case Study 1)

In the interview, the TPCK framework was explained to MSTE1. After the clarification, he was asked to identify which areas within the framework that he perceived he had dealt with in his class. The question posed to him was, "Which of these areas in the TPCK framework have you dealt with in your course?" MSTE1 marked all of the sections in the TPCK framework to indicate that he had sufficiently addressed all of the teacher knowledge components in his Educational Technology courses. MSTE1 did not ask for further clarification about the TPCK framework during the explanation. He had assumed that because he utilised basic principles of Instructional Design in the creation and delivery process of his course, his efforts can be equated to addressing all the components under Pedagogical Knowledge and Technological Knowledge in the TPCK framework. He further explained that, since he was teaching an Educational Technology course, due to the nature and scope of the learning content in the course, it was sufficient to assume that he had already dealt with the Content Knowledge component of the framework.

In retrospect, it seemed likely that the approach used during the interview influenced the way MSTE1 responded to the questions. At the beginning of the interview, MSTE1 was aware that the researcher was employed by another university and held a similar teaching portfolio to his. MSTE1 might have been influenced by the line of questioning used by the researcher. MSTE1 gave an impression that he wanted to present his work in a positive light, as having considered all aspects of the TPCK framework, even though specific comments during the rest of the interview suggest that he did not have a full and detailed understanding of some of the elements he claimed to have addressed.

When MSTE1 attempted to justify his claims about how he fostered Teacher Knowledge, there was little evidence of any distinction between Content Knowledge and Technology Knowledge, in that he used these concepts interchangeably throughout the interview. The responses implied MSTE1 tried to suit his responses to meet the expectations of the researcher. He might not have been exposed to or been familiar with the concepts used in the TPCK framework. There was also a possibility that MSTE1 might not have communicated his thoughts or impressions about the nature of teacher knowledge with any colleague or peer before, orally or in writing. In other words, the input from MSTE1 might have been a result of his lack of knowledge about Teacher Knowledge, rather than a deliberate strategy to acknowledge that all the TPCK knowledge types existed in his course. Probable circumstances such as being guarded about his position as an academic and being responsive toward the interview's tone and probing research objectives might have played a part in the way MSTE1 responded to the questions in the interview.

TE1 was also asked how he taught Content Knowledge (as he had previously categorised it) to his students. TE1 explained: "I cover basic knowledge. ...a few related terminologies. If [the students] know them, as they should know, they would know. If they do not know [the terminologies], they should go find out." The statement illustrates the skeletal approach that he used in teaching the content of his Educational Technology course. He used the term "basic knowledge" very loosely to categorise content that he taught in his courses. His use of the word "basic" could also be interpreted to indicate the quantity and level of knowledge he disseminates in his course. The narrative also reflected MSTE1's assumption about the responsibilities of students in his course – they were expected to play a major role in exploring further the minimal presentation of content in his course. When asked to elaborate, MSTE1 concentrated heavily on presenting technical language to his students in his Educational Technology course, and there was little or no evidence to indicate that he went beyond explaining definitions of what he called "key terminologies."

When asked about Constructivism, TE1 explained that he designed the student projects using Constructivist principles. He believed this sufficiently demonstrated the integration of Constructivist principles into his instruction. When asked to elaborate in greater detail, he showed a few examples of the project requirements which he had designed for his students, and presented arguments as to how each of the requirements reflected the use of Constructivist principles.

Below are some of the examples MSTE1 presented during the interview as evidence.

a) Assignment One: Students are asked to choose one of nine topics covered in the course. They are required to do an internet search about the topic they chose and in a team of three to four people, prepare an MS Word document of the information they found about the selected topic and present the information in an MS PowerPoint presentation. MSTE1 explained that the assignment was designed to encourage students to collaborate with their peers to achieve the same learning outcome ("collaboration" being the key Constructivist element promoted in this task).

b) Assignment Two: Students are asked to choose one out of six "technical" topics (the focus is on creating "School Networks"). They are asked to work in teams of three to four persons, and arrange for interviews with school teachers or private companies (who have been identified to have a working Network on their premises). The students are to document their experiences in interviewing their chosen participants in a blog, and submit an MS Word document as the final product for the project. MSTE1 explained that the assignment further enhances the value of collaborative work. They would have to learn to be independent in acquiring data and resources for the task ("independent learning" being the key Constructivist element promoted in this task).

c) Assignment 3: In teams of three, students are asked to assume roles as consultants, to devise a school networking scheme, and they are required to include five elements in their proposal:

    i. Network type;

ii. Proposed topology;

iii. Types and quantity of servers needed;

iv. Equipment required; and

v. Communication media to be made available.

The task requires students to work collaboratively to produce a coherent proposal for an actual work setting. TE1 explained that the task promotes "authentic learning", another Constructivist element embedded into the design of the project.

All of MSTE1's course materials are published online, on a course website that he created for all courses he taught at the university. At the time of the interview, MSTE1 explained that University Z did not use any virtual learning environment, and consequently, he took on the responsibility to scout for viable resources online that would enable him to host course materials and online forums for his students. He was actively looking into open-source learning platforms at the time of the interview, because he thought that the learning platforms would enable him to "customise the learning platform based on students' and course's needs." In his explanations, he suggested that by putting the materials online, the students would be able to access their learning resources independently and hence "active learning is encouraged," which he associated with the "active learning principle" in the Constructivist theory.

When asked further to describe a typical lesson in his Educational Technology course, this was the resulting exchange between MSTE1 and the researcher (translated from Malay):

Researcher:	What about your contact hours in the class...How many hours [of] lecture [do you deliver]?
MSTE1:	Three hours.
R:	Three hours of lectures…and tutorials?
MSTE1:	Hmmm... Direct, direct... [That same] three hours...
R:	Right...
MSTE1:	The lecture hours include a lecture and hands-on [tutorial] for them.

R:	Right...
MSTE1:	Normally, the first thirty minutes, I give them instructions and everything... and then I let them go... go...
R:	Okay.
MSTE1:	Vice versa...whatever they want to do... (Depending) on the content of that day...
R:	So (each lecture session) is done in one shot? One day only per week?
MSTE1:	Yes, just a day (a week).
R:	I see.
MSTE1:	It's exhausting...(laughs)

The dialogue captures a snapshot of how MSTE1 perceived the way he handled the teaching of his Educational Technology course. In his words, his teaching style allows room for students to learn on their own, with minimum input in the conventional format of lecturing from him. His approach can also be loosely classified as a Constructivist approach to teaching. His students are encouraged to learn independently during class time, before they are asked to apply the newly acquired knowledge in practice. However, there was no mention or evidence of any instructional strategy that he might have used in his course that would indicate that students were sufficiently guided and challenged throughout their task to explore "key terminologies" in Educational Technology.

The interview with MSTE1 also revealed the way he understood Constructivism and how it was positioned in his Educational Technology course. Below is an exchange from the interview:

R:	What is your opinion about using Constructivist theory in Educational Technology courses?
MSTE1:	Very good.
R:	Yeah?
MSTE1:	Yeah, because students will learn about... okay... beyond what we can ever expect. But we have to track, because in this world of internet, the students will find a plethora of things. Sometimes they would get lost in the information network, and we have to pull them back and make them do what we want. We must set our [course] objectives...

MSTE1's remarks above illustrate how he perceived his strategy to put Constructivism into action. He believed the best way to make his students learn is to make them explore knowledge on their own, but as a tutor, he plays a crucial role in tracking and monitoring student activity. His words, "...we have to pull them back and make them do what we want," suggest that his intentions are to control his students, implying a more objectivist-oriented approach to managing the learning actions of his students.

MSTE1 spoke at length about the types of technologies that he introduced to his students in the course, and justified that he embedded pedagogical elements into the course by making students work in groups and independently find resources for their course projects. The reason behind the design of the class projects was to motivate students to "learn independently", another Constructivist principle that he associated with his approach to teaching. In the course syllabus, however, there was no mention of teaching specific lessons or topics related to integrating pedagogical constructs into the use of Educational Technology.

Table 8.2:

Analysis Table for MSTE1's Narratives (Espoused Theories)

Knowledge Type	**Evidence of Practice/Existence**	**Status**
Content Knowledge	Course reading list	Present
Pedagogical Knowledge	Course reading list	Present
Technological Knowledge	Course reading list	Present
Pedagogical Content Knowledge	Course reading list	Present
Technological Content Knowledge	Course reading list	Present
Technological Pedagogical Knowledge	Course reading list	Present
Technological Pedagogical Content Knowledge	Course reading list	Present
Constructivism in CK	Course reading list	Present
Constructivism in TK	Course reading list	Present
Constructivism in PK	Course reading list	Present
Constructivism in PCK	Course reading list	Present

Constructivism in TPK	Course reading list	Present
Constructivism in TPCK	Course reading list	Present
Constructivism	Course reading list	Present

In sum, MSTE1 was confident about his provision of opportunities for his students to engage in the teacher knowledge development process, through his choice of instructional delivery, selection of course materials and design of class projects.

8.3.1.2 Summary of Analysis

The interview illustrated how teacher knowledge was addressed from the point of view of the course instructor who has been teaching the Educational Technology course over the past ten years. He equated his approach, which required him to negotiate principles of Instructional design into his course design and delivery approach, as his way to address the pedagogical constructs of teacher knowledge in his course. MSTE1 held the view that he addressed Content Knowledge in his course, because he was teaching "learning content" to his students. Constructivism, in his account, contained elements of an objectivist-oriented learning process. In the interview, he described how he liked to keep a close eye on what students were doing in the class, though he allowed them to "explore knowledge" on their own, without providing evidence of scaffolded instruction to support his students' learning experiences.

In sum, in the interview, MSTE1 has revealed how he often used technical terms associated with Constructivism to justify his pedagogy. He utilised the technical terms to describe the types of learning experiences that he hoped his students would engage in when they attempted to undertake their course projects. From MSTE1's descriptions, the scope of content depicted in the course syllabus implied a very technical orientation to Educational Technology, in that it covered specific topics about setting up physical hardware and networks for school use. MSTE1 claimed, however, that this focus naturally meant that he had adequately covered all aspects of teacher knowledge in his Educational technology. Though MSTE1 claimed all TPCK elements are addressed in his course, there was very little evidence that all the elements were, in fact, taken into consideration in the design and delivery of his Educational Technology course.

8.3.2 Student Teacher Interviews

The two student teachers interviewed for this study were enrolled in the Educational Technology course taught by MSTE1 at the time of the interview. Both had been invited to participate in the interview individually, but they insisted on being interviewed together.

In terms of ethical considerations about interview these students as a pair, both respondents were told of the implications of providing an interview in a group. The researcher went through each item in the interview with each respondent by providing them ample time to answer separately.

Student Teacher 1 (MSST1) was introduced to technology, particularly ICT, when she was ten years old, while still in Primary School. She owned a computer at home and was able to learn how to use MS Word. However, she only learned other basic MS and Internet applications when she started her university studies. She rated herself as “7 out of 10” on ICT skills proficiency, as she thought she needed many more tools and skills in ICT to categorise herself as an IT expert. Her motive to enrol into the Teacher Education programme was mainly self-driven, as she has always aspired to work with children since she was a young girl.

Student Teacher 2 (MSST2) only learned to use computers formally when she enrolled into the university. In her primary and secondary education, she did not have the opportunity to learn anything about technology because she came from a rural area, and her primary and secondary schools were not equipped with technology tools. MSST2 also rated herself as a “7 out of 10” on the ICT skill proficiency scale. She explained that though her father purchased a home PC for her personal use when she was ten, she did not perceive that she was as literate in her computing skills as she should be (she compared herself to other students who were in her programme).

At the time of the interview, the students had both taken seven Educational Technology courses, and they would have one more Educational Technology course to study and another academic year to complete the teacher education programme.

8.3.2.1 Analysis of the Interviews

Figure 8.2 represents a mapping of the narratives gathered from these student teachers, using the TPCK framework.

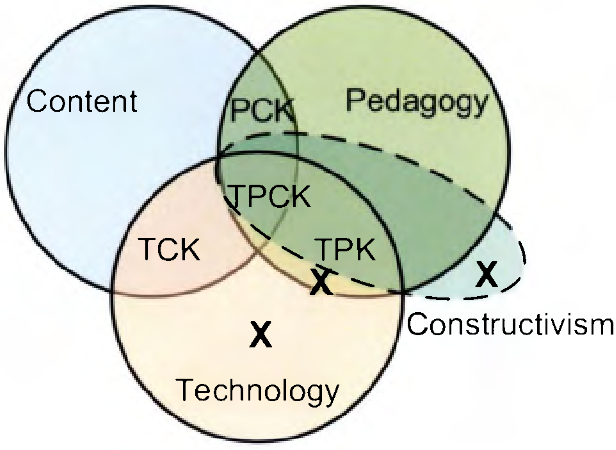

Figure 8.2: Mapping of MSST1-MSST2's Narratives onto the Adapted TPCK Framework
(Case Study 1)

After an explanation about the adapted TPCK framework, the students were asked if they could identify lessons or projects in their current Educational Technology course that had addressed Technological Pedagogical Content Knowledge. Below are their initial responses on this issue:

> I think, up till this point, there is some talk about this, but I think we need to learn more about it – (MSST1)

> I think we just learned about it a bit – (MSST2)

The responses illustrate how the students perceived that they have learnt at a superficial level about TPCK in their course. Their words also highlight their inability to explain the things they said they had learnt in the course. These students seemed to realise their courses lacked emphasis on TPCK, as shown by responses to other questions posed in the interview.

For example, one of the students, MSST1, commented:

> Not everyone knows about pedagogy and how it is applied in(to) Educational Technology. For me, I know how to use technology, but it doesn't mean I

> know about pedagogy. So I think they have to go hand-in-hand, and we have to know both. I have to read up a lot to know how to teach. We not only teach students how to do math, but also how he will use math in his daily life too. If a student doesn't know how to do math, that means we need to use resources that will make him understand, like real world materials, so he will be able to visualise the resources. If we use technology, that means teaching or pedagogy will have to go hand-in-hand. Besides, using the correct pedagogical approach, technology can be included, so the teaching becomes more enriched.

Her comment reflected her anxiety about her roles and responsibilities when teaching in a classroom, and she also recognised the need to learn to use technology in line with pedagogical strategies, as well as the learning content. She also believed that when all three components featured in TPCK are addressed effectively, her instructional delivery would be of a high standard.

Both student teachers went on to describe how they thought their learning of Content Knowledge, Pedagogical Knowledge and Technology Knowledge had been addressed in their current Educational Technology course:

> I don't think we have learned enough. We must, because we are not in the real world yet. We have not learned about it yet, we learned the theories, but that is not the same as the practical experience. If we go to school, only then we will know if what we have learned (in the teacher education programme) was enough, or otherwise. So we can develop our teaching further. (MSST1)

> I don't think my assignments helped me a lot (to learn about TPCK). (MSST1)

Their feedback suggests that they perceive inadequacies in what they have learnt compared to what their expectations might have been. In these comments, the student teachers deduced that they would be able to assess how much they know and have learnt from the programme once they start teaching in actual classrooms. They also agreed that their course projects did not contribute to an understanding of what could be described as Content Knowledge, Pedagogical Knowledge and Technology Knowledge.

The students' claim that their courses did not provide knowledge about TPCK may be influenced by the students' personal understanding about the nature of their own cognition. They have not been exposed to TPCK terminology, and they may have tried to make connections with topics that they are more familiar with or have studied in their courses. Their response, which suggested the blame was placed on the teacher educators, may not be well-founded, because there was a possibility that these students lacked the knowledge they needed to describe, or even, reflect upon their knowledge.

In order to address these concerns about their general claims, the students were asked about the process of learning about lesson plans in their Educational Technology courses. They were candid in describing that their process of lesson planning was merely a mechanical procedure to complete using readily available templates. They revealed:

> "Usually when we do lesson plans, we just type things up in the [lesson plan] template. (MSST2)
>
> When we do lesson plans, first we have to think about the topic and subtopics we would like to teach. For instance, if we want to teach about animals, we need an introduction first. In the introduction, that's the time we use PowerPoint, and then the rest of the lesson, we can tell a story [about animals], and to conclude the lesson, we can show the PowerPoint slides again to the students... they will be attracted to the lesson in the first showing of the slides, and when they show some interest, we can go on and tell them more things, give them more stories... (MSST1)

When they described how they made decisions about choosing and scaffolding learning content in their lesson plans, the use of technology was not crucial to the lesson they planned, signalling the fact that their main concern for the lesson was not the use of technology, or the lesson planning, but rather on getting the lesson holistically executed. In brief, their perception of a complete lesson was when it was made up of a list of learning objectives, presentation of learning content, reinforcement tasks and assessment features embedded in the lesson plan.

In general, in the interview, the students expressed the belief that they had not learned sufficient about combining pedagogy and technology in their Educational Technology courses. In their narratives, it appeared that these students used a "cookie-cutter approach" to design lessons in their Educational Technology course projects. When they were asked to select learning content for a lesson, they would find ways to use a selected content with any technology tool assigned in their course projects. From the narratives, it was implied that there were no instances of teaching or revising pedagogical theories within the course itself. The students claimed they relied on a lesson plan template to create lessons to complete their course projects.

When asked about Constructivism, the student teachers said:

> Constructivism... depends on the teacher... more to the teacher giving information... kids explore on their own to find something. (MSST1)

> The teacher assumes a role as a facilitator, so the kids can get the information. (MSST2)

> It's about 'exploring', isn't it? We give a game or courseware to the student so he can explore the game himself, meaning, if he has some prior knowledge, and the teacher has explained a bit, he will explore the game himself, and he will therefore add to his knowledge that way... From the beginning, we [as a teacher] must know that we need to expect the students [to] have some prior knowledge, and we are just there to add on to what the students already have – that means we add on to the students' thinking skills, the way the students do something, because sometimes when the students come to school, we already know they know something already. We just need to develop what the students have, and if there are errors in things they know, we need to correct them. (MSST1)

These narratives are analogous to previous excerpts from narratives about TPCK. The student teachers' espoused theories are closely parallel to what they believed to be the primary role of a teacher in the classroom and how a student was to be dealt with in a classroom setting. There was mention of "developing thinking skills" when they talked about Constructivist teaching, though neither elaborated on the types of thinking skills, or on how thinking skills were to be taught or developed in a lesson. The strongest point that both student teachers wanted to highlight was that Constructivism was about understanding that "students have prior knowledge," and it was this "prior knowledge" that would be "worked on" in the lessons. This phrase was repeated a few times in the interview, indicating how crucial these two student teachers perceived the importance of the concept. Their use of these labels also suggested that they did have an understanding of some commonly cited Constructivist principles.

Table 8.3:

Analysis Table for ST1-2's Narratives (Espoused Theories)

Knowledge Type	**Evidence of Practice/Existence**	Status

Content Knowledge	Topics in the syllabus	Present
Pedagogical Knowledge	Topics in the syllabus	Present
Technological Knowledge	Topics in the syllabus	Present
Pedagogical Content Knowledge	Requirement in course assignment	Present
Technological Content Knowledge	None presented	Nil
Technological Pedagogical Knowledge	None presented	Nil
Technological Pedagogical Content Knowledge	None presented	Nil
Constructivism in CK	None presented	Nil
Constructivism in TK	None presented	Nil
Constructivism in PK	None presented	Nil
Constructivism in PCK	None presented	Nil
Constructivism in TPK	None presented	Nil
Constructivism in TPCK	None presented	Nil
Constructivism	Topics in course syllabus	Present

Further into the interview, the students were asked to describe how Constructivism was taught to them in the course, in relation to the technology tools that they were learning. These are their answers:

> Critical thinking, yes, we took a paper on that. There was some explanation on that. (MSST2)
>
> [It's about] making the kids think... If we ask the students, they will think about something. For example, we bring a real-world material to class, and we ask them to describe it. The students will talk about the item, its colour, smell, taste and so forth. (MSST1)

From these student teachers' accounts, it appeared that Constructivism might not have been clearly addressed in their Educational Technology course. The students were able to link the concept of Critical Thinking to Constructivism, indicating that they had an understanding about one of the key principles of learning advocated by the Constructivist theory. In the interview, the students recalled their past classroom experiences of learning about Critical Thinking. They tried to make connections between what they understood about early childhood learning with one critical thinking skill, *self-exploration*. However, when asked to elaborate further, they were not able to provide examples relating to their current course on Educational Technology.

In the interview, Constructivism seemed to be misinterpreted in action, in terms of the use of simplistic tasks to justify the integration of Constructivism into their course. It was possible that the students did not have sufficient opportunity to articulate their knowledge about Constructivist theory. Hence, the students were compelled to use terms that they were more familiar with to define the theory. Similarly, the line of questioning in the interview may not have been sufficiently rigorous to acquire finer details of the students' understanding. Nonetheless, evidence of a more sophisticated or detailed understanding of Constructivism was absent.

8.3.2.2 Summary of the Interviews

The narratives displayed incongruence in the student teachers' accounts of their learning of Educational Technology at University X. In the interview, the students presented their views on how they were learning about technology. They were asked to elaborate on how they dealt with content and pedagogy in the instructional design process of their course projects. Both respondents agreed that they did not have sufficient knowledge about integrating Content Knowledge and Pedagogical Knowledge with their knowledge of technology. When asked about their understanding of Constructivism, they both repeatedly used the phrases "explore" and "prior knowledge" in the interview, which they clearly associated closely with the idea of using Constructivism in the classroom. Their conception of Constructivism appeared to revolve around the notion that a teacher's role is to recognise that students have prior knowledge when they enter a learning environment. The teacher is responsible for encouraging students to discover knowledge at their own pace and by their own means. Based on these narratives, there was no reported inclusion of Constructivist elements in any phase of their learning experience in the Educational Technology course. The closest example of "self-exploratory learning" could be identified from the narratives which described the students' classroom experience. They had been asked to "explore" technical terms which were presented in the class and they were subsequently asked to present their findings to the rest of the class.

It emerged from the questions posed to them in the interview that both student teachers realised that they had more things to learn before they could say they were fully prepared to teach a lesson using technology in an actual classroom setting.

The next section reviews class artefacts from the course. Comparisons were made between the respondents' espoused theories and their theories-in-action, in the form of the class artefacts.

8.3.3 Course Artefacts

The students in Case Study 1 were intended to learn about setting up computer networks, specifically in selecting and managing appropriate software and hardware for an efficient network set-up. The students went through two formats of course evaluation: formative and summative evaluation. All three assignments, which carried 60 percent of the total grade, were to be completed as group projects and students were allowed to select their team members.

For the purpose of this study, MSTE1was contacted at the end of the academic semester, after all assessments had been completed and he had graded the written assignments. The teacher educator was asked to select three student projects which illustrated the best, average and weakest work, based on MSTE1's criteria for assessment.

Three student projects were sent in by MSTE1 for the analysis of this study. From the project covers, the students seemed to have compiled all three separate assignments into one large document. The content of each assignment, according to the assignment descriptors are noted in the following list.

a) Assignment 1 (15% of total grade) – From a list of nine topics (all lecture topics from the course), the students were asked to choose one topic, and expand on it by searching for information through books, magazines, the internet and so forth. The students were asked to compile all the information they could find on the selected topic and assemble it into an MS Word document, and a summary of their work was also to be prepared using MS PowerPoint.

b) Assignment 2 (20% of total grade) – The students were assigned to study the infrastructure of a network at a school or a business entity, to find out how the network was set up, its topology, communication technologies used, software applications used, and also issues and challenges faced by the people responsible for the setting up of the network. The students were then asked to write about what they had investigated in report format, and also to publish it online in blog format.

c) Assignment 3 (25% of total grade) – The students were asked to assume the role of consultants to a school, and the main remit of their role was to design an appropriate plan to network the school premises. They were asked to draw on their previous assignments, to help them complete a workable plan that would be plausible for recommendation to a school which required networking solutions.

The next section describes how the three assignments sent in by MSTE1 match the elements in the TPCK framework, as evidence of theories-in-action. In the analysis process, the artefact MSTE1 classified as "best" was explored first, and the "weakest" was considered last.

8.3.3.1 Class Artefact 1

The project document illustrated how closely instructions provided in the assignment descriptor were followed. The students selected a topic of choice and they wrote an essay to explain the resources they had found on the topic. They also included a section on "history" to present how network technologies have evolved over the years. The project also had one section on the architecture of a network management system, and it included key terminology often used in IT networking literature. However, there was no reference list provided in the document, to indicate the actual sources of information used in the project.

In the project document, the second assignment was also presented according to the specifications articulated in the assignment descriptor. The students reported on an interview they conducted at a local college. They elaborated on the network architecture used by the college for their IT Network systems.

In the final part of the project document, the students presented their proposal for a school's IT Network. They selected a school and they provided a plan which included a budget proposal for the school. The document was presented as manual. It was intended for anyone who might be interested in taking up the plan to build the school's IT network from scratch. The students also made a list of forms that could be digitised and placed online. The forms were designed to minimise administrative workload in the school. The final section of this document had a short list of references used in the project.

Figure 8.3 below depicts how the project document is mapped onto the TPCK framework:

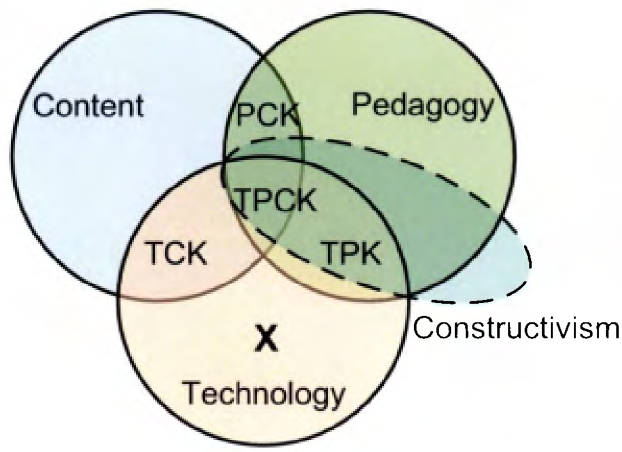

Figure 8.3: Mapping of Class Artefact 1 from Student Teachers onto the Adapted TPCK Framework (Case Study 1)

Figure 8.3 above illustrates how only Technology Knowledge (TK) was addressed in the student project. The project focused mainly on the technical side of the topic, specifically in dealing only with IT networks in a school environment. There was no evidence of addressing Content Knowledge or Pedagogical Knowledge, which would have indicated that these types of teacher knowledge were taken into consideration in the design of technology infrastructure described in the assignment. The students were asked to search and produce information that was closely mapped to the overall course structure, and there was no opportunity for them to link the potential of the technology with subject matter content or pedagogical elements. The students followed the instructions of the assignment descriptors very closely, and there was no consideration of the types of content knowledge or pedagogical knowledge that may influence the way a school's IT network would be designed or laid out in their IT Architectural plan.

Table 8.4:

Analysis Table for Class Artefact 1 (Theories-in-Action)

Knowledge Type	Evidence of Practice/Existence	Status
Content Knowledge	None presented.	Nil
Pedagogical Knowledge	None presented.	Nil
Technological Knowledge	Clearly evident in project document.	Present
Pedagogical Content Knowledge	None presented.	Nil
Technological Content Knowledge	None presented.	Nil
Technological Pedagogical Knowledge	None presented.	Nil
Technological Pedagogical Content Knowledge	None presented.	Nil
Constructivism in CK	None presented.	Nil
Constructivism in TK	None presented.	Nil
Constructivism in PK	None presented.	Nil
Constructivism in PCK	None presented.	Nil
Constructivism in TPK	None presented.	Nil
Constructivism in TPCK	None presented.	Nil
Constructivism	None presented.	Nil

The content of the document did not exhibit any consideration for any pedagogical theory. The Constructivist theory was not taken into account in the project document. There was no evidence in the assignment descriptor that included instructions to integrate elements of Constructivism into the development of the project. It was also unclear how students were assessed for this project. This project document was graded A by MSTE1.

8.3.3.2 Class Artefact 2

The students who completed the second project document also followed the assignment descriptors closely. One notable difference in this document in comparison to the one previously reviewed was that this document included more graphics that were closely linked to the topic they selected for their project. In the second assignment presented in the project document, the students provided a lengthy description about each network component used at a school where they conducted their mini-research. However, there was a noticeable lack of anecdotal evidence in the document, which might have added value to the quality of their project work. In general, most of the information they included in the write-up could have been sourced from general literature about ICT and computing networks, though no source was quoted or listed using any referencing format in the whole document. The final assignment presented in the project document described a proposal for a school that the students had selected for their IT Network task. The design proposal described a basic network plan suitable for a small school, as stated in the requirements for the project. The document did not include any detail about the school population and types of computing tasks that might have influenced the choice of IT network design proposed. The document contained descriptions of various technology components needed in the school's IT network, but did not include information about how the technology elements would be utilised by the target user group.

Figure 8.4 illustrates how this second project document is mapped onto the TPCK framework.

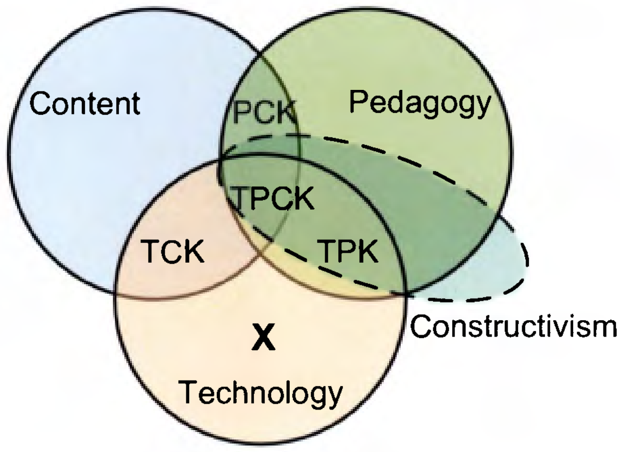

Figure 8.4: Mapping of Class Artefact 2 from Student Teachers onto the Adapted TPCK Framework (Case Study 1)

Similarly to the first document, as anticipated, this document did not put any weight on teaching and learning processes that might influence the way the proposed IT network was designed. The instructions were clearly about focusing on the technical requirements and procedures, and the students did not include any consideration pertaining to the learning content or pedagogical designs that may influence the way the network would be set up for the school. There was no mention of how the network set-up in the school they visited affected the teaching and learning processes at the school, and the students' report seemed to be more concerned about the number of computers and the capabilities of the networking hardware and software, rather than the application perspective of the network design. This project document was graded B+ by MSTE1. Since no marking rubric was given with the assignments, it was impossible to analyse how the assessment criteria were used by the teacher educator.

Table 8.5:

Analysis Table for Class Artefact 2 (Theories-in-Action)

Knowledge Type	Evidence of Practice/Existence	Status
Content Knowledge	None presented.	Nil
Pedagogical Knowledge	None presented.	Nil
Technological Knowledge	Clearly evident in project document.	Present
Pedagogical Content Knowledge	None presented.	Nil
Technological Content Knowledge	None presented.	Nil
Technological Pedagogical Knowledge	None presented.	Nil
Technological Pedagogical Content Knowledge	None presented.	Nil
Constructivism in CK	None presented.	Nil
Constructivism in TK	None presented.	Nil
Constructivism in PK	None presented.	Nil
Constructivism in PCK	None presented.	Nil
Constructivism in TPK	None presented.	Nil
Constructivism in TPCK	None presented.	Nil
Constructivism	None presented.	Nil

8.3.3.3 Class Artefact 3

Physically, the document was noticeably thinner than the previous two. The first part of the assignment which explored a selected topic of interest from the course syllabus was done in a glossary-like format, and there was no quotation of resources used in the entire assignment. The second assignment was a report of an interview at a business location. The students presented the way the IT network for the business entity was designed, and it is similar to the information that they presented in the first assignment. They also included a page from their group blog, but the content of their entries were illegible. For the final assignment on designing a school's IT network plan, the students chose a rural school as their location for the project. Their proposed plan, like the other documents, was strictly on explaining the many components of an

IT network. There was no justification given as to why they chose to use the technology for the school they selected.

Figure 8.5 below depicts how content from the project document was mapped onto the TPCK framework.

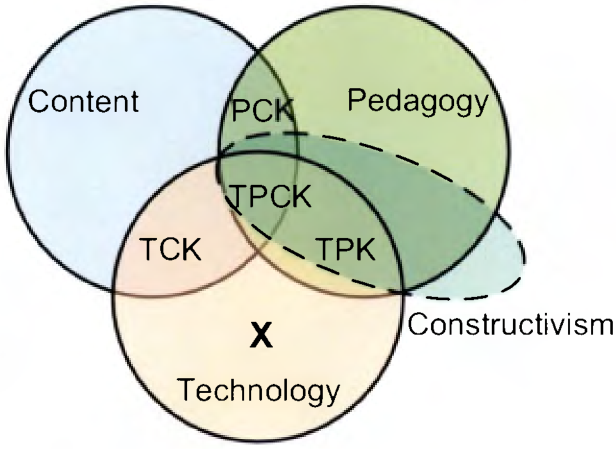

Figure 8.5: Mapping of Class Artefact 3 from Student Teachers onto the Adapted TPCK Framework (Case Study 1)

The Fgure 8.5 above illustrates how the document content was noticeably similar to the previous two, in terms of how teacher knowledge was dealt with in the student projects.

The project did not present any reference or linkage to any learning content from a subject discipline (to indicate Content Knowledge was dealt with) or any pedagogical element (to prove Pedagogical Knowledge was dealt with), and for the most part, the students only concentrated on the technical side of using technology (Technology Knowledge), specifically in the processes of designing an IT network. The students had opted to interview personnel from a corporate entity which had been using IT at their workplace for their second assignment. Consequently, the context limited the content of the students' essay to how an IT network functioned within a corporate environment, rather than a learning environment in a school or college. The third assignment contained only the technical specifications of hardware and software needed to set up an IT network. This project document was graded C by MSTE1.

Table 8.6:

Analysis Table for Class Artefact 3 (Theories-in-Action)

Knowledge Type	Evidence of Practice/Existence	Status
Content Knowledge	None presented.	Nil
Pedagogical Knowledge	None presented.	Nil
Technological Knowledge	Clearly evident in project document.	Present
Pedagogical Content Knowledge	None presented.	Nil
Technological Content Knowledge	None presented.	Nil
Technological Pedagogical Knowledge	None presented.	Nil
Technological Pedagogical Content Knowledge	None presented.	Nil
Constructivism in CK	None presented.	Nil
Constructivism in TK	None presented.	Nil
Constructivism in PK	None presented.	Nil
Constructivism in PCK	None presented.	Nil
Constructivism in TPK	None presented.	Nil
Constructivism in TPCK	None presented.	Nil
Constructivism	None presented.	Nil

In sum, all three student projects provided insight into how teacher knowledge is put into action through the design of a series of assignments in an Educational Technology course. These projects have revealed how Technology Knowledge was strongly emphasised, and the students adhered to the assignment descriptors very closely, and consequently they produced a technically oriented document which did not address either content or pedagogical knowledge (CK or PK). The students' theories–in-action about how teacher knowledge was addressed in this Educational Technology course have illustrated the strong focus on technology knowledge (TK), and the learning content presented in the assignments echoed the lecture topics presented in the course. Upon closer analysis, the orientation of these assignments appeared to be more appropriate for students who are majoring in ICT, and may not be interested in using ICT for educational purposes. The projects illustrate the danger in shifting focus to the more technical nature of the course at the expense of other elements in Educational Technology.

Pedagogical and content knowledge are both neglected. The overlapping areas as featured in TPCK were not included in the course assignment. The depth of the content presented in these project documents also illustrated a simplistic overview about network technology and its components. The students have relied on textbook-type definitions to explain the IT systems and tools they selected for their assignments. They did not offer any other educational content beyond the prescribed instructions.

All three project documents evidently point to one conclusion. The students' theories-in-action concerning teacher knowledge in their Educational Technology course were biased toward Technology Knowledge (TK). Other types of Teacher Knowledge as featured in the TPCK model were not included in the assignment design.

8.3.4 Class Observation

The class session observed was one titled, "The Web and School Networks." The student teachers who were enrolled in this course were pre-service teachers, majoring in Islamic Studies. This was the only course that MSTE1 was teaching for the semester. The researcher was invited by MSTE1 to observe a three-hour session, after the one-to-one interview with MSTE1.

On the course syllabus, the overall course goals stated that, by the end of the course, students would be able to explain the processes of creating a complete computer network in a school. They were also expected to be able to describe the functions of equipment and software to be used to create an information system network. Students were assessed using two formats; 60 percent of their total grade through formative assessments (projects and presentations), and 40 percent through an end-of-semester examination. MSTE1 had built a course website before classes began, to provide access for students to download lecture slides from the website. The class website was aimed to reduce note-taking during class time. Students met for four hours each week, in a 14-week semester that began in January 2007.

During the class session, teaching was conducted by an invited guest, Mr N. The course instructor, MSTE1, had arranged to engage Mr. N to teach a few sessions in the course. Mr N has established himself as an expert in the field. He was one of MSTE1's former students who took a similar course many years ago at University Z. According to MSTE1Mr. N was an exemplary role model for the pre-service teachers in the course. Mr. N has been working as a network consultant and he has already established his reputation as a specialist in designing network systems for a number of large-scale organisations in the country. Mr. N, however, did not have any teaching experience or qualification prior to teaching this lesson. The class session was to be his first experience in teaching a university course. The topic for the day was "Building School Networks." It required hands-on practice during class time. Students were allocated a computer terminal each during the lecture. They were asked to follow specific technical protocols to conduct specially designed learning tasks during the session.

Mr. N appeared to have engaged the entire class's attention successfully throughout the three-hour lecture session. From the start, he briefly informed the students about what he would teach them in the lesson. He explained how he would show them "very useful computing techniques" in his lecture. The novelty of his presence in the class and the promises he made at the beginning of the lecture session kept the students' attention throughout the session. The students animatedly took their places behind one terminal each as the class began.

Throughout the lesson, the students seemed to be engaged mostly by the technology jargon and skills introduced in the lesson. They actively tried out each technical skill on their own computer terminals, as they were introduced by Mr. N. There were two notable learning events that took place in the session. The first was that Mr. N showed a 20-minute video clip he downloaded from the web which explained the process data flow in an IT network. Students were asked to focus their attention on the video and were asked to stop doing any other work during the video viewing. The second was that Mr. N demonstrated a skill that he claimed would be useful for the students – hacking into a real IT system. He showed the students how to hack into another student's computer within the same class. He then asked them to replicate his demonstration, by hacking into any computer they choose to break into within the perimeter of the classroom during the session.

In the first learning activity, the video show appeared to be an isolated event, in that there were no learning goals attached to the viewing task. There was no introduction or summary of key points of content presented in the video. The video content did not offer explanations that would be advantageous to the students to understand how important it was to set up an effective IT network for a school. Upon viewing during the interview, the content of the video appeared to be targeted for mass public viewing (as seen from the structure and presentation of the content on the video clip). In terms of associating the content of the topic of the day's lesson and the content from the video clip, there was no linkage or inter-referencing made between the two constructs. The students, at this stage of the teacher education programme, may be expected to be competent in structuring any learning experience on their own, and the teacher educator may have an assumption that his students are capable of discriminating aspects of the video that related to the course syllabus.

The hacking task did not appear to be explicitly linked to any part of the topic for the day. Though the students seemed excited about acquiring a new technical skill to use on their peers, there was no evidence to indicate the link of the activity to the topic of the day's class. Similarly to the video show earlier on, there was no explicit introduction or linkage made by Mr N or MSTE1 to other learning content presented in the class, or any prior session.

8.3.4.1 Analysis of Class Session

When the activities and communications that took place in the lecture session are mapped onto the TPCK framework, they could be represented by **Figure 8.6.**

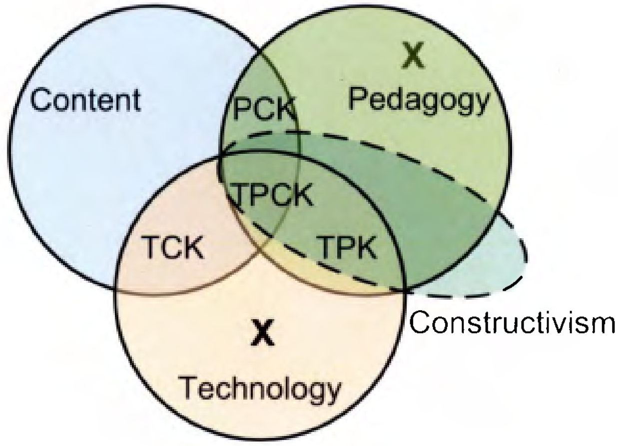

Figure 8.6: Mapping of Evidence from Class Observation onto the Adapted TPCK Framework (Case Study 1)

Figure 8.6 illustrates the types of knowledge categories which were observed in the lesson. The areas covered in the lecture were Pedagogical Knowledge (PK) and Technology knowledge (TK). The evidence is analogous to MSTE1's narrative but it did not corroborate his claims about addressing all aspects of TPCK. In the interview, MSTE1 emphasised the strong association made with Technology Knowledge due to the nature and scope of the course. In the class session, Technology Knowledge was the main content of the lesson.

It was interpreted that Pedagogical Knowledge was addressed in the class, although there was no obvious reference made to any learning theories or constructs, including any principles of Constructivism during the class session. PK was present in the execution of the lesson. PK was the basis of the instructional design of the lesson. The theory used was Behaviourism. In parts of the lesson, content was demonstrated to the students. Soon after, the students were asked to copy the demonstration. Students learned through trial and error, a classic Behaviourist learning principle.

The learning goals stated in the course syllabus implied that they were framed to achieve the lower levels of Bloom's Taxonomy. For instance, one of the course goals stated that students were expected to be able to "identify network equipment and software required to set up an information system in a school." The learning goals represented evidence for the scope and depth of the lesson. In the course, it appeared that the scope of learning was limited to identifying and categorising ICT tools. In the interview with TE1, using or considering practical ICT skills that required students to engage in higher level learning activities was mentioned; however, the learning aim was not observed in the class session. There was an underlying assumption in the course syllabus that when students were taught how to identify appropriate network tools (through the teaching in this course), they would be able to set up an IT network of acceptable quality for a school. There was no evidence of linking technology to other subject matter content in the observed class.

Table 8.7:

Analysis Table for Class Observation (Theories-in-Action)

Knowledge Type	Evidence of Practice/Existence	Status
Content Knowledge	None presented	Nil
Pedagogical Knowledge	Use of drill and practice and trial-and-error strategy with the students	Present
Technological Knowledge	Evidence in content of lesson	Present
Pedagogical Content Knowledge	None presented	Nil
Technological Content Knowledge	None presented	Nil
Technological Pedagogical Knowledge	None presented	Nil
Technological Pedagogical Content Knowledge	None presented	Nil
Constructivism in CK	None presented	Nil
Constructivism in TK	None presented	Nil
Constructivism in PK	None presented	Nil
Constructivism in PCK	None presented	Nil
Constructivism in TPK	None presented	Nil
Constructivism in TPCK	None presented	Nil
Constructivism	None presented	Nil

Overall, the course as structured in the syllabus was an introductory course about the basic concepts of school network infrastructures.

8.3.4.2 Summary of Class Session

The observed session illustrates one instance of an Educational Technology course which was taught at University Z. The class session illustrated how Content Knowledge was associated very closely with the provision of Technology Knowledge. The student teachers were presented with learning content that was relevant to the nature of the course (which was on "Building School Networks"); however, there was no clear evidence that Content Knowledge was differentiated from Technology Knowledge. There was also no evidence that Subject Matter Content (or Content Knowledge as used in this study) was addressed in any of the other topics taught in the course. In the class observation, the lesson was presented using a range of short ten to fifteen minute lectures which were interspersed with hands-on practical tasks and a video presentation. Pedagogical Knowledge was utilised in practice, but it was not obvious if it was treated as a topic in the lesson. There was also no evidence of Constructivist theory being used in the observed class.

Thus the first case study has observed one instance of classroom teaching. The course delivery provided an example of how Technological Knowledge was used as Content Knowledge, in a course on Educational Technology. Upon analysis, TPCK elements were not addressed, despite the claims made by the teacher educator in his interview with the researcher. Constructivism was not integrated as a learning approach in the Educational Technology course, although commonly used jargon to describe Constructivist learning was imprecisely used to describe personal conceptions about teaching and learning in the course.

A further analysis of the case study is presented in Chapter 11, to illustrate the range of patterns seen across all three case studies. The following two chapters present findings from the rest of the case studies acquired in the main study.

Chapter 9: Main Study - Case 2

9.1 Introduction

This chapter presents the second in the series of case studies undertaken during the main study phase. Case Study 2 consists of data from another instance of an Educational Technology course. The class was taught by PSTE2 to a group of students who specialised in Early Childhood Education at University Z.

There are four types of data acquired from Case 2; the teacher educator interview, two sets of student teacher interviews, a class observation, and various classroom artefacts (student projects were selected by the teacher educator to indicate the best, average and lowest achievers of success in the observed Educational Technology course).

9.2 Teacher Educator Interview

MSTE2 was a lecturer who had just joined University Z and in the Educational Technology field. She completed her Master's degree at University Z. Before beginning her academic career with the university, she taught English at a local secondary school.

At the beginning of the interview, MSTE2 was asked to rate her ICT skills. The motive for the question was to cursorily gauge the teacher educator's personal perception about her own technology competency. MSTE2 rated herself as a "7 out of 10". Her rationale was that she thought her technical skills were not as good as she had wanted them to be. She perceived that her strength as a lecturer in the Educational Technology field lay in her knowledge about Instructional Design. When asked to describe her self-perception of her role as a teacher educator, she categorised herself as an educator, and repeatedly pointing out that "I am not an IT person" in the interview. Her claims emphasised her preference to be perceived as someone with expertise in pedagogy rather than technology in education.

In designing learning activities for her students, MSTE2 clearly said that she preferred her students to work in groups rather than individually. Her justification was that "...students who are weak can learn from those who are better." She expected the "poorer students" (to denote those she perceived to be academically weak) to use their own initiative to improve their IT skills, not depend on her to learn everything she taught in her classes. She said that the students could seek help from their peers who were studying IT full-time, to help them gain ground in mastering adequate IT skills at the level she expected in her Educational Technology courses.

Students who were currently enrolled in her course were Early Childhood Education majors. The students were in their second year, and have taken several Learning Theories and Pedagogy courses.

When asked about her course, she stated that she adhered to the main remit of the course, which was on the teaching of Multimedia Education. From the beginning, she said she has assumed that students already knew about basic Learning Theories and they were already capable of choosing the most appropriate pedagogical elements to incorporate into classroom teaching. To help her students learn better, MSTE2 prepared small tutorial packages for the whole course and asked her students to keep a journal throughout the duration of the course, to record their individual reflections about their progress in the course. The student journals were handed in weekly to PSTE2 and were used as evidence of personal development on topics learned in the course.

9.2.1 Analysis of the Interview

At the time of interview, the adapted TPCK framework was included in the interview. The representation of teacher knowledge which was categorised in the framework was explained to all respondents. Each respondent was asked to mark the spaces in the framework which they perceived as being addressed in their respective Educational Technology courses.

In the interview, when MSTE2 was shown the TPCK framework and asked to indicate her own perception of the way she dealt with Teacher Knowledge elements in her Educational Technology course, she marked all the spaces she perceived to be covered in her course, as depicted below.

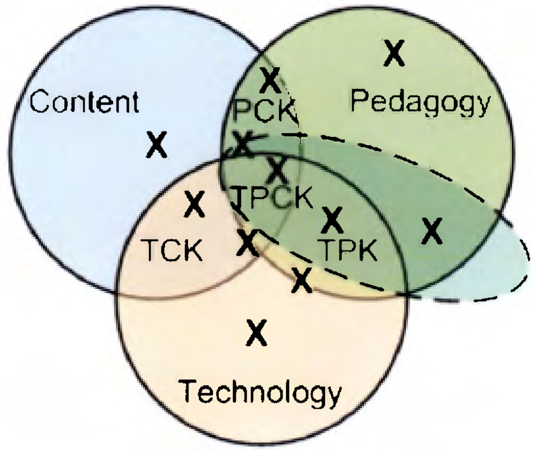

Figure 9.1: Mapping of MSTE2's Narratives onto the Adapted TPCK Framework (Case Study 2)

MSTE2 claimed that she addressed all components in the framework in her Educational Technology course. She stated that all the components were relevant to the content of the course and she had no doubt that these components were dealt with in the course, either from the lectures, course projects or course assessments. When asked to provide evidence of her actions, she commented:

> Because they [the students] are producing something in teaching and learning, so, when I check what I monitor every week, I would address elements of like... target group.... OK, so, this is your range of target group. So, they have already learnt how to teach these [groups of] people... because I am not teaching them that... somebody [else] is teaching them that.... so, I ask them to incorporate [what they have previously learnt]. That's how...

This statement illustrated her perceptions about addressing teacher knowledge in her course. Her judgment about the treatment of TPCK took into account other contextual elements in setting up a learning experience. She associated "identifying a target group of users" as a strategy to address TPCK. Her narrative also indicated her reliance on students recalling prior learning experiences in other courses, which were related to the learning of Content Knowledge and Pedagogical Knowledge.

Further into the interview, when asked to elaborate on how she addressed Content Knowledge in her course, she stated: "I won't bring up the Content [knowledge] to the Technology environment. So, I'm more into Multimedia..." Her testimony suggested that Content Knowledge was assumed, and that she does not allow space for Content Knowledge in her courses, despite initially claiming that she covered all aspects of teacher knowledge in her courses. Her account also gave the impression that MSTE2 presumed her students had already adequately learned Content Knowledge and Pedagogical Knowledge from other courses, prior to enrolling into her Educational Technology course. In the narrative, she acknowledged that she did not teach these knowledge types in her courses, but she expected students to be able to incorporate what they have learnt in previous courses into the projects that she required them to accomplish in her courses.

When asked to indicate evidence of addressing Pedagogical Knowledge, she described how she asked the student teachers to reflect on the learning theories that they have already learnt from other courses (prior to enrolling into her course), and the students were encouraged to use elements of any pedagogical framework that they found relevant to the learning content and student tasks in her course. MSTE2 said her course content did not include any teaching about pedagogical theories, and therefore she did not teach it explicitly to her students. In her view, because she taught the students about principles of Instructional Design in the course, it was sufficient to assume that Pedagogical Knowledge was addressed in the course. She said:

> When I check their work every week...they have already learned about pedagogical theories in other courses, so I ask them to incorporate that into their projects.

When asked further about how she "asked them to incorporate" pedagogical theories in the student projects, she briefly said she made them go through the instructional design steps of the ADDIE model (this is an instructional systems design model which comprises five instructional design phases, "Analyse", "Design", "Develop", "Implement" and "Evaluate," was introduced by Dick and Carey in 1978).

To understand how she dealt with Pedagogical Knowledge, she was asked to elaborate further on what she actually advised her students on:

> When I look at their choice of colours, I told them it's not the way to do it, so that's the pedagogy bit there addressed. I don't give them a lecture like, this is how you do it.... like this, like this and like this (action: gesturing shapes in the air)... I don't do that.

In her account, she made an association between "selecting colours" (which was a "design" decision) and "the teaching of Pedagogical Knowledge" (which referred to the time she guided her students who were working on an E-book project). She was emphatic about the fact that she did not prescribe to students what they should do in their projects. She was firm that she did not want to dictate the way her students learn in her class. Instead, she focused her teaching strategies on demonstrating the outcomes she expected of her students through the projects.

MSTE2 also described what she taught about writing learning outcomes as a pedagogical strategy in any courseware development project:

> When doing a courseware, you need to know the audience. The students would put so many learning objectives, and I would ask them to remove them because they don't understand how the many objectives would affect their audience's learning process.

In this description, similar sentiments about "showing students how to do it" clearly illustrate that it was a preferred teaching approach in MSTE2's courses.

MSTE2 also explained her instructional strategy to address individual competencies in her courses. She explained that she would normally meet her students individually in her office if the students' questions could not be solved or addressed during class time.

When MSTE2 was asked about how she taught Technological Content Knowledge, she gave a scenario where she taught students (Religious Studies majors) how to utilise appropriate graphics and texts to teach Arabic numerals. She knew that there was a lack of ICT resources to assist the teaching of Religious Studies in schools. She explained how she took the opportunity in her course to demonstrate how to use available ICT resources to create authentic teaching materials.

According to MSTE2, although she did not believe that Constructivism could work in a conventional school lesson, she stated that she incorporated it in her teacher training course: "I think I am basically basing all of my teaching on Constructivism." From her own teaching experience in Malaysian schools before lecturing at University Z, she deduced that Constructivism could only be used with students with advanced levels of knowledge, and that it would not work with poorer students. She said:

> You can use Constructivism…but you have to create the environment.

When further asked why she thought she should teach the student teachers in her Educational Technology courses at the university about Constructivism, she explained:

> It might be useful… If they create their own materials, it's more valuable to the students… and they enjoy what they like, and they learn a lot.

The assumption reflected in this interpretation, is of the existence of a connection she perceived between the processes of creating learning materials and the students' level of enjoyment of the learning process. She also associated students' learning enjoyment with success in the learning process.

MSTE2 was also asked about the way she integrated Constructivist principles in her course. She described her stand about using Constructivism in her class:

> As a teacher, I think we need to use it [Constructivism] more of the time (right)... Like constructing their own knowledge, all those stuff... Basically what I'm teaching, most of my... [teaching]... most are Constructivism....

She described how she asked students to show her what they label as "interactive" in their projects, and then she showed them what she thought "interactive" was, and what is not, based on the components of the student projects. She elaborated:

> At one point, I ask them to put something 'interactive' [in their E-book project]... so 'Interactive' to me, I describe [it as]... How do I put this... Like when there is a 'response'... I demonstrate to them... like this (gesturing her demonstration techniques)... [This is] interactive... There is 'interaction,' I would say... So they'll understand my expectation of 'interaction…'

When asked to elaborate further about how her students have learnt about Constructivism in her courses, TE2 explained how Constructivism is embedded. She also stated that her students did not consciously learn about Constructivism in her courses. The following excerpt was taken from the interview to illustrate what MSTE2 said about Constructivism being embedded in her course.

> Researcher: What about the students that you have taught before? Have they ever come to ask you or told you about the use of Constructivism in the class?
>
> MSTE2: Oh, no, they didn't. They didn't know about this Constructivism.... They don't realise it.

R:	Do you think that it is necessary for us, teaching at university level training these teachers, that we include Constructivism in our teaching?
MSTE2:	I mean... you mean... in letting them know… Okay, Constructivism… errr...
R:	Basically knowing the principles, and utilising it...
MSTE2:	OK.... I never thought of it.... because it's embedded... in the course.... It might be useful [too], you see, because, when they create their own, it is like more valuable to the students and they enjoy doing it...

In the interview, it was not clear what MSTE2 understood about using Constructivism in her courses, though she seemed keen to use Constructivist labels to indicate the existence of Constructivism in her courses.

This similar impression was revealed consistently throughout this interview. However, one fact that may have driven MSTE2 to respond the way she did was the way the design of the experiment offered in this study.

Table 9.1 illustrates TE2's analysis of her treatment of TPCK and Constructivism in her course.

Table 9.1:

Analysis Table for TE2's Narratives (Espoused Theories)

Knowledge Type	Evidence of Practice/Existence	Status
Content Knowledge	Topics in course syllabus	Present
Pedagogical Knowledge	Integrated in course tasks	Present
Technological Knowledge	Topics in course syllabus	Present
Pedagogical Content Knowledge	Integrated in course tasks	Present
Technological Content Knowledge	Integrated in course tasks	Present
Technological Pedagogical Knowledge	Integrated in course tasks	Present
Technological Pedagogical Content Knowledge	Integrated in course tasks	Present
Constructivism in CK	Included in her teaching approach	Present
Constructivism in TK	Included in her teaching approach	Present

Constructivism in PK	Included in her teaching approach	Present
Constructivism in PCK	Included in her teaching approach	Present
Constructivism in TPK	Included in her teaching approach	Present
Constructivism in TPCK	Included in her teaching approach	Present
Constructivism	Included in her teaching approach	Present

9.2.2 Summary of the Interview

The interview with MSTE2 revealed interesting conceptions about the way teacher knowledge was dealt with in her Educational Technology courses. Though TE2 represented her perceptions about how she addressed components of TPCK in her course in a similar pattern to the one described by MSTE1, MSTE2's personal take on each component varied slightly from those captured in MSTE1's narratives.

In her courses, MSTE2 concentrated solely on developing her students' technical skills and she expected her students to derive pedagogical knowledge and content from courses that the students would have taken prior to their enrolment into her course. Similar to MSTE1's explanation, she also expected her students to use their own initiative to learn technical skills independently in her course. Most of the time, students were grouped into small teams and were expected to collaborate with their peers throughout most projects and class tasks. In her narrative, TE2 believed that she had dealt with all aspects of developing teacher knowledge in her course, though only a handful of evidence was gathered that substantiated her claims.

The interview provided valuable insight into how misinterpretations about the concepts of teacher knowledge and Constructivist principles could happen, as seen from the interpretations described by TE2 in dealing with her students' activities and questions.

9.3 Student Teacher Interviews 1

The first student teacher interviewed (MSST2A) became interested in pursuing a career in education when she watched her mother and sisters teach in primary and secondary schools in Kuala Lumpur. At the time of the study, she was enrolled in a four-year residential programme at University Z, with Early Childhood Education as her major.

When asked to rate herself on her ICT competency, she appraised herself as a "7 out of 10". She explained that though she has learned to use computers at home since she was thirteen and she has been using basic ICT applications and playing games, she felt that she still needed to learn more about ICT, and claimed that she was very much "still in the learning process."

9.3.1 Analysis of the Interview

MSST2A's narratives were mapped onto the TPCK framework, and the result is shown in **Figure 9.2**.

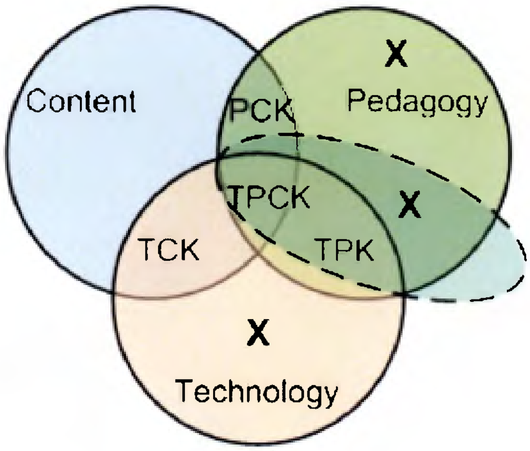

Figure 9.2: Mapping of MSST2A's Narratives onto the Adapted TPCK Framework (Case Study 2)

After describing the components in the TPCK framework, MSST2A was asked if she had learnt about each type of teacher knowledge in the Educational Technology course that she was enrolled for that semester. She said she thought the course did teach her parts of the teacher knowledge types presented in the framework but she also felt that she had not "done any exercises on it." In the interview, MSST2A repeatedly implied that, to her, for learning to be considered "complete", some form of "exercise" would have to be performed by her students. Because of the belief that completing a task signified the learner had learned something, MSST2A felt that she had not completely learned about each type of teacher knowledge as presented in the TPCK framework, because she had not gone through sufficient tasks to help her learn these concepts.

Further into the interview, she described what she understood by teacher knowledge (after the TPCK framework was explained to her). MSST2A stated:

> ...OK, you can give [the students] to explore the coursework, and they will learn how to read, how to [use] numbers, right... courseware and lesson plan also...

Her description suggests that she had linked the concept of learning about teaching with technology to the use of lesson plans. She further explained:

> [Since this is for] kindy [kindergarten] level, we have to create easy course ware, easy to learn, interesting, and it can also interact [with the kids].

Her rationalisation here displays how she made connections between the courseware she was designing and the learning elements which she presumed would be appropriate for the cognitive level of children targeted as primary users of the courseware.

When asked further to elaborate on what she thought about the role of Technology Knowledge in learning, MSST2A said:

> I think computer(s) are interesting because they can use a song, they have games, they can play the exercise, kids like something moving and colourful, right?... I really think so, because we can see nowadays, kids very love computer, right, they want to play game and they like something like VCD, right?...[and normally] kids [would be more attracted to play] games, right? It's hard for the occasion, so we must make the courseware more to be like games to them.

Her claim illustrates how she conceptualised the relationship between computers and the learning process, in that she thought if students were "having fun and playing games," any courseware that a teacher creates for a classroom has to mimic the way games are designed to ensure that the courseware is fun to use.

When MSST2A was asked what she understood about Constructivism, her response was:

> Lecture[r] will tell us about what kids like, and what they want... and in the courseware... and in the learning process...

This narrative revealed that MSST2A relied on MSTE2 to tell her about student profiles and learning preferences. MSST2A then used the information to create her project using learning principles that she believed to be Constructivist.

MSST2A was further asked to elaborate on what she understood to be a successful Constructivist lesson, to which she responded:

> When students are work on the assigned exercises... then if they can answer correctly, that means 'success'...

This explanation is an indication of how ST2A perceived the success of learning using Constructivist principles. The same line of justification was used when the student teacher was asked to elaborate on what she understood of her training on Constructivism:

> ...that's why we must have exercise in our courseware right? So, when they use it, they will try to remember what they read and then they will answer the question and then we can see.... they can remember.... or [if they] just read a story and [they] don't remember that...

This narrative suggests that MSST2A linked the inclusion of exercises with (in the context of the interview) the courseware development project that she was doing. She believed that by doing and completing the given exercises, the students would learn a chunk of knowledge constructively. Up to this point in the interview, it was consistently evident from her narratives that MSST2A's view about Constructivism appeared to be more of a Behaviourist approach to teaching, prescriptive rather than constructive.

She was also asked how she would measure her students' success, to which she replied:

> ask [the students] in the exercise, ask about how to spell, and then maybe I break them [the class] up into their [animals] different habitats, and divide them [the types of animals] into three, right? Marine, land and amphibians... and I would divide [the class] by groups...

References in her reply were made to the topic she chose to teach in the courseware that she was building, which was about aspects of the Animal Kingdom. The narrative revealed MSSTA2's conceptions about learning success, and what she understood of the process of Constructivist learning. It appeared that her version of Constructivism was about clustering and categorising items or ideas, all of which indicated that her interpretations about Constructivism were Behaviourist-oriented.

9.3.2 Summary of the Interview

It can be concluded that, in the interview, MSST2A did not reveal how content knowledge was addressed in the Educational Technology course that she attended. She did, however, describe how she has considered Content Knowledge in the design of her course projects. When designing a project, she would start by choosing a topic she liked. She would then develop relevant materials for the topic to match the ICT tools that she was working with for the course projects. She would design activities that would use the materials she had chosen, and would include an assessment feature at the end of the project, as a strategy to check learning comprehension.

In terms of exploring her conceptions about Constructivism, MSST2A appeared to associate Constructivism with the idea that courseware should have exercises based on the learning theory, and when students are able to complete the specific exercises, this indicated that they had successfully completed the learning process using Constructivism. In essence, her idea of Constructivism is more prescriptive than constructive. MSST2A also avoided giving direct answers to questions about how she perceived her own experience with how teacher knowledge was handled in her teacher training programme.

Table 9.2:

Analysis Table for MSST2A's Narratives (Espoused Theories)

Knowledge Type	Evidence of Practice/Existence	Status
Content Knowledge	None presented	Nil
Pedagogical Knowledge	Requirement in course assignment	Present
Technological Knowledge	Content of course	Present
Pedagogical Content Knowledge	None presented	Nil
Technological Content Knowledge	None presented	Nil
Technological Pedagogical Knowledge	None presented	Nil
Pedagogical Technological Content Knowledge	None presented	Nil
Constructivism in CK	None presented	Nil
Constructivism in TK	None presented	Nil
Constructivism in PK	None presented	Nil
Constructivism in PCK	None presented	Nil
Constructivism in TPK	Requirement of course assignment	Present
Constructivism in TPCK	None presented	Nil
Constructivism	None presented	Nil

It was difficult to map data from this interview onto the TPCK framework because ST2A did not reveal her espoused theories about the treatment of teacher knowledge in her course. Her answers revealed more about what she thought were the advantages of using technology in the classroom; however, she could not provide evidence of specific learning incidents which would have shed some light on how she perceived her training of Educational Technology in the course. Her understanding about Constructivism appeared to be limited, in that she only related the concept of 'interactivity' to the notion of integrating Constructivism into the pedagogical design of courseware. She also seemed to believe Constructivist principles were more about imposing a set of learning tasks to be completed, to indicate that a lesson has been done and completed successfully, much like those prescribed by Behaviourist theory.

Evidence of how each type of teacher knowledge was taught to her was also vague. Her narratives appeared to be muddled. It was not easy to decipher what she understood about Educational Technology (as a field of study) and the development process of creating a courseware project (which was on building an E-book for pre-schoolers). In sum, her narratives provided a perplexing perspective about the relationship between Educational Technology (as a field) and the use of technical tools (to produce work that proved she had learned about Educational Technology). ST2A also described how she thought Constructivism was represented in her courses, by using commonly used labels like interactivity to denote the existence of Constructivist elements within her learning experience in the course.

The next section will feature the narratives acquired from two more student teachers who were enrolled in the same Educational Technology course.

9.4 Student Teacher Interviews 2

The second interview was conducted with two students (MSST2B and MSST2C) who were enrolled in the same course as MSST2A. Both students said that they preferred to be interviewed together so they did not have to compromise on their packed schedule at the university. The interview was conducted during class time, with permission from the teacher educator. MSTE2 argued that, since the class session for the Educational Technology course was meant for students to work on their individual projects and that no teaching would be conducted, these students were available for interview during class time.

At the beginning of the interview, both students surprisingly revealed that they did not choose to major in Education and they were not interested in becoming teachers. They had aspired to major in Economics, but due to parental pressures, they had applied for a place to study Early Childhood Education at University Z. In the interview, they both agreed that after a year of starting the teacher education programme, they had begun to develop a strong liking for the teaching profession, specifically in dealing with the education of young pre-schoolers.

Both student teachers were also asked to rate themselves on a scale of 1 to 10, to indicate their perceived levels of ICT skills. Both students agreed that they believed they stood at "5". They both thought they had "a long way to go." MSST2B said although she had learned to use ICT when she was thirteen, she only used her ICT skills to surf the internet and to play games. MSST2C said that she had never used a computer to present her work, and she had only begun to learn to use it for professional purposes in the Educational technology courses she took at the university. MSST2C admitted that she had learnt to use computers in primary school, but in her computing classes, she only learnt typing; in secondary school, she learned about using spreadsheets and presentation applications. At university, she felt that she was struggling and "suffering" to use computers, because she had to deal with "animation" and on the whole, she felt that learning ICT was a challenging task.

9.4.1 Analysis of the Interview

When the interview was mapped onto the TPCK framework, it is as illustrated in Figure 9.3 below.

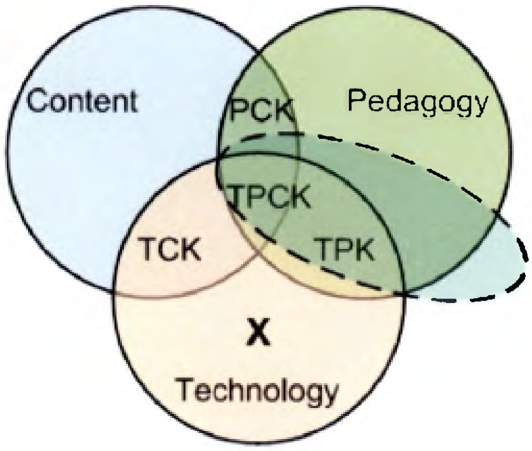

Figure 9.3: Mapping of MSST2B and MSST2C's Narratives onto the Adapted TPCK Framework (Case Study 2)

The student teachers were asked about their perceptions of learning about teacher knowledge in the Educational Technology courses at University X. They quickly answered this with:

> We just start[ed] to learn the PowerPoint, never learn how to teach the student, because we [are] just [in our] first year [of studies].

This comment illustrates how the training of these would-be teachers was handled at University X. It was immediately evident that the students' perceptions about teacher knowledge in the courses were strongly associated with learning about specific software applications. At the first instance, the student teachers immediately thought about learning of technical skills, rather than linking features and usage to learning content or any particular pedagogical theory or approach.

The students further elaborated:

> Maybe we will learn in the future… we [are] also not sure about our course[s], maybe like now, one of the assignment[s] now is [about] e-story book, and then [it] is quite interest[ing]…maybe in [the] future, we can create a story for our students…

The narrative further suggested how the goal of their Educational Technology course appeared to be outcome-oriented, and that students were expected to produce technically enriched products to demonstrate their learning achievements in these courses. Further into the interview, these students also revealed that they felt "confused" about the aims of their Educational Technology course, because there seemed to be "an artistic slant" to the way their assignments were designed. The students' reflection about the way the Educational Technology course was presented to them showed how the emphasis of the course was not built around designing pedagogically sound learning content, but rather on the technical and interface aspects of the learning products.

The student teachers were asked about their perceptions of a teacher's role in using ICT in the classroom. They both thought that teachers would never be made redundant due to the increasing use of ICT in the classroom. They thought that "the teacher also has to lead and guide them [the children]." They explained:

> If [teachers do not guide the kids in the classroom], the kids...if you let them [sit] in front of the computer, maybe some of the kids, not everyone, will know how to use [the computer], so maybe they [will become] blur in front of the computer... So maybe, a teacher [is needed] to guide the kids, how to start the computer, winder, how to click where, click here... at least... the teacher is [supposed] to guide them, although this computer is [a teaching aid] for them to learn more about technology.

This narrative indicated a strong emphasis on how young children were expected to learn about ICT's technical aspects. In the interview, there was no reference made to content or pedagogical integration in a technology-assisted lesson.

When the students were given a scenario to suggest how they would deal with the artistic and technical appeal of commercially produced educational software, the students were not able to provide a comprehensible reaction. MSST2B said, "I don't know what to say [to] that." MSST2C attempted to respond, and said:

> Kids still do not know how to compare [the commercial versus those the teachers would create from scratch], so I think, what we would built would be simpler and more interesting, and therefore the kids will find it easier [to use].

Their conceptions about the acceptability of their technology products depended on the naivety and inexperience of young children in using technology-enhanced learning objects, instead of basing their argument on content relevance or pedagogic rationales.

When asked about Constructivism, both student teachers provided a vague description of what they thought it was. They said,

> It was my first time hearing about Behaviourism.. It's like 'experience', like how to let the kids to learn, like, their 'experience,' like hands-on.

When asked to further describe what they understood about Constructivism, they gave an example:

> When you see an apple, right?, if we ask them [the kids] to write A-P-P-L-E, maybe the students only write down or draw [out] the apple, I think...What we understand how to make the kids get use[d] to make them fast [quickly] remember what we teach, make them in the situation, [we] can feel that kind of situation.

When pressed further to explain what "situation" meant to them, they said:

> Like, we want to teach them the animation.

They were referring to the animation items that they were incorporating in their e-book project.

When asked if they had considered using Constructivism in any of their assignments in the Educational Technology course, both student teachers replied, "No, not really."

Table 9.3:

Analysis Table for MSST2B and MSST2C's Narratives (Espoused Theories)

Knowledge Type	Evidence of Practice/Existence	Status
Content Knowledge	None presented	Nil
Pedagogical Knowledge	None presented	Nil
Technological Knowledge	Requirement of course assignment	Present
Pedagogical Content Knowledge	None presented	Nil
Technological Content Knowledge	None presented	Nil
Technological Pedagogical Knowledge	None presented	Nil
Pedagogical Technological Content Knowledge	None presented	Nil
Constructivism in CK	None presented	Nil
Constructivism in TK	None presented	Nil
Constructivism in PK	None presented	Nil
Constructivism in PCK	None presented	Nil
Constructivism in TPK	None presented	Nil
Constructivism in TPCK	None presented	Nil
Constructivism	None presented	Nil

9.4.2 Summary of the Interview

Key findings from the interview reveal that these student teachers perceived that they were still in the process of building their competencies in understanding how technology fits into a lesson design. Educational Technology courses they were enrolled in at University X emphasised mastering technical skills to use technology, and the students articulated that they were not sufficiently confident to describe what they understood about integrating content and pedagogy into a technology-enriched product (which they have been asked to produce for the course, as a significant indicator of success in learning about Educational Technology). Similarly to the responses from other student teachers who participated in this study, these students did not perceive that content knowledge and pedagogical knowledge were integrated into their Educational technology courses at the university. They also loosely described their understanding of learning theories generally, and Constructivism specifically, suggesting that they did not have adequate comprehension of how learning theories relate to the use of technology in the classroom.

The students interviewed were in their first year of teacher training and parts of their narratives might have been better articulated if they were interviewed at a later stage in their teacher training programme when they were more competent and proficient in their field of study. However the interviews provided a useful insight from these first year student teachers. The data showed how Educational Technology courses were first introduced to them. It also revealed their understanding about how technology fitted within their teacher training programme.

9.5 Class Artefacts

This Educational Technology course is designed to teach student teachers about applying technology in support of learning. The course synopsis stated that students would learn to use basic MS Office applications, namely Word, PowerPoint, Excel and Publisher. Student work was evaluated in two formats; formative (80% of total grade) and summative (remaining 20%) assessment. The formative assessments were made up of minor assignments that required students to use selected Office applications. The students subsequently were asked to consolidate all they have learned into one large project. The summative assessment came at the end of the course; the students sat for a final examination, to account for the final 20 percent of their grade.

The project that was analysed for this study came in the form of an E-book. Students were required to design and create an E-book, using MS PowerPoint as their main tool, and the E-book is targeted for children at pre-school age. The choice of target audience was determined because the students who were taking the course for the current semester were Early Childhood Education majors. The idea of the project was to design an E-book which would be suitable for teaching young children the alphabet, numbers and so forth.

At the end of the semester, TE2 was contacted to acquire copies of graded student projects. Two sets of the projects were sent to the researcher. One project was graded

B, and the other was graded C. Both projects are copies of print-screens of PowerPoint slides and they were analysed using the adapted TPCK framework.

9.5.1 Class Artefact 1

The student project began with short rhymes to introduce farm animals in a barn. While introducing the animals, numbers were introduced (from 1 to 10). The courseware was most likely meant to assist young children to learn numbers as they read about the farm animals. At the end of the introduction, there was a series of slides of a traditional children's song, Old McDonald, complete with an icon to click to listen to an audio file of the song. The following slide reads "It's Learn Time", signalling a new concept in the E-book. The same animals were featured again with pictures and sound files. Instructions on the top of the page asked users to click on pictures of the animals to hear the name of each animal. Users were also asked to click on the sound icon beneath the pictures to hear the sound that each animal made (for example: "quack" for duck). Ten animals were featured in this section. In the next section, the same animals were displayed again and numbers were introduced with each animal. The instruction of the top of the page reads: "Click on the numbers to learn." The number of animals was associated with the numbers featured on the slides (example: Three horses to feature the number 3). The final section of the document, a section called "Have fun with animals," asked children to play a Sound Alike game on the computer, and the children were asked to match the sound of each animal to the correct animal. There were also two slides which would appear, one would indicate when a child chose the correct and the other when they chose an incorrect answer.

Figure 9.4 depicts how the content of Artefact 1 was mapped onto the TPCK framework.

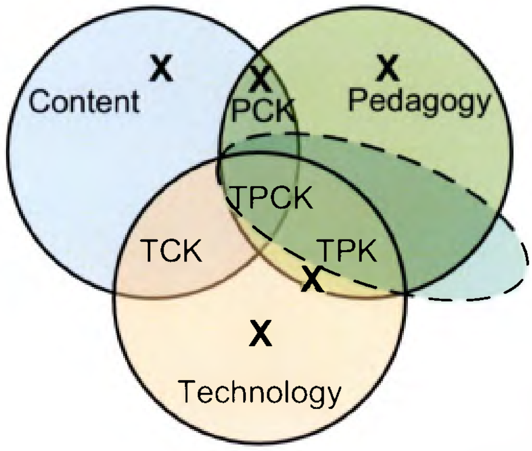

Figure 9.4: Mapping of Content from Artefact 1 onto the Adapted TPCK Framework (Case Study 2)

Figure 9.4 illustrates five sections in the TPCK framework which were addressed in the project document. The students had used resources from Early Learning for their project and this indicated that Content Knowledge was addressed in their project. In this project, there was a structure provided at the beginning of the E-book to guide the children and positive/negative feedback was also included. The use of the structure indicated that a pedagogical consideration (PK) was integrated into the design of the E-book, though the overall learning process was simplistic and objectivist-oriented.

In the E-book, there were also a few instances of feedback included into the slides, which indicated that Pedagogical Content Knowledge (PCK) was considered in the design of the E-book. This was in response to answers provided by users on two item-matching exercises.

To adopt a more generous and lenient interpretation of pedagogical integration in the technical features of the E-book, the use of Next buttons could be deemed as an attempt to address the Technological Pedagogical Knowledge (TPK), though at a very superficial level. Such buttons, which were primarily used to signpost content, were also used to structure the lesson, and to correct user errors. Technological Knowledge appeared to be dealt with in the use of various tools in PowerPoint to present the content of the E-book, namely insertions of multiple graphics, sound files, use of various fonts in different sizes and colours, and integration of buttons and icons throughout the E-book. TPCK was not addressed in this project document, and Constructivist elements were not clearly evident in the presentation of the learning content in Artefact 1. There appeared to be a lack of interactivity in the design of the

E-books – children who are targeted to use the E-book would not experience flexibility in the content presentation as they are only expected to click the "next page" button each time they want to move forward in the E-book.

Table 9.4:

Analysis Table for Class Artefact 1 (Theories-in-Action)

Knowledge Type	Evidence of Practice/Existence	Status
Content Knowledge	Use of learning content from subject matter discipline	Present
Pedagogical Knowledge	Use of instructional design principles to structure project	Present
Technological Knowledge	Use of various technical tools	Present
Pedagogical Content Knowledge	Element of feedback included	Present
Technological Content Knowledge	None presented	Nil
Technological Pedagogical Knowledge	Use of buttons to signpost content	Present
Pedagogical Technological Content Knowledge	None presented	Nil
Constructivism in CK	None presented	Nil
Constructivism in TK	None presented	Nil
Constructivism in PK	None presented	Nil
Constructivism in PCK	None presented	Nil
Constructivism in TPK	None presented	Nil
Constructivism in TPCK	None presented	Nil
Constructivism	None presented	Nil

9.5.2 Class Artefact 2

The project document was graded C. It began with an introductory page about the entire assignment, which explained the general content of the E-book, designed for children nine years of age and below. A synopsis explained that the story in the E-book was about a little girl named Jenny who went to visit her grandmother's vegetable garden. The key objective of the E-book is to teach about different types of vegetables. The lesson began with introducing Jenny, and her plans to visit her grandmother's vegetable garden. The next slides introduced ten types of vegetables, with pictures and labels. The next slides tested the children's memory about all ten vegetables, in which children were asked to choose the correct vegetable with the label shown on each slide. There was no positive or negative feedback provided. The last slide contained a congratulatory message to Jenny for completing the tasks in the E-book.

Figure 9.5 represents the mapping of this content.

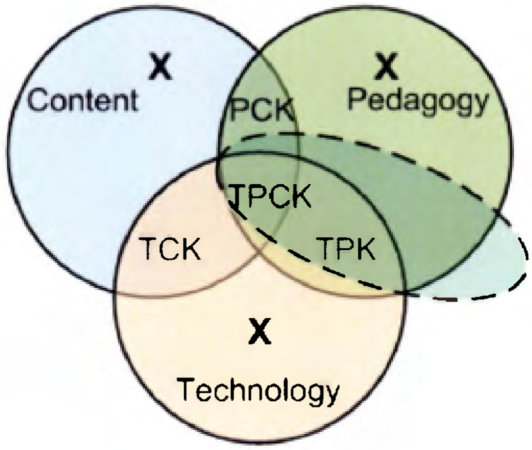

Figure 9.5: Mapping of Content from Artefact 2 onto the Adapted TPCK Framework (Case Study 2)

Artefact 2 represented a strong focus on the technical side of using technology. Content Knowledge (CK) was addressed as the learning content for the E-book was set to teach about names of vegetables. Pedagogical Knowledge (PK) was dealt with in a minimal manner, as there were introductory slides to orientate users to the context of the lesson in the E-book and there was also a final message at the end of the E-book to signal the end of the lesson. Technology Knowledge (TK) was prominently addressed, there was a dependence on users clicking on icons and buttons on the slides to move forwards or backwards in the E-book. Technology Knowledge was used heavily by the creators of the E-book, as they incorporated various graphical features (such as animation and hyperlinks) into the E-book design. There was no evidence of Constructivist principles put into practice in the artefacts either, and it was not clear if it was considered in the design process of the E-books.

There were no assignment descriptors provided by MSTE2, so it was difficult to gauge the requirements for student projects in this course. Although it was clear from the course syllabus that the course was intended to teach about applications of multimedia technology into lessons, it was not obvious how the E-book was assessed.

Table 9.5:

Analysis Table for Class Artefact 2 (Theories-in-Action)

Knowledge Type	**Evidence of Practice/Existence**	**Status**
Content Knowledge	Use of learning content from subject matter discipline	Present
Pedagogical Knowledge	Signposting at the beginning of courseware	Present
Technological Knowledge	Use of various technical tools	Present
Pedagogical Content Knowledge	None presented	Nil
Technological Content Knowledge	None presented	Nil
Technological Pedagogical Knowledge	None presented	Nil
Pedagogical Technological Content Knowledge	None presented	Nil
Constructivism in CK	None presented	Nil
Constructivism in TK	None presented	Nil
Constructivism in PK	None presented	Nil
Constructivism in PCK	None presented	Nil
Constructivism in TPK	None presented	Nil
Constructivism in TPCK	None presented	Nil
Constructivism	None presented	Nil

9.5.2.1 Summary of the Class Artefacts

It was clear that content knowledge, pedagogical and technology knowledge were addressed in both class artefacts, but to varying depths. The learning content was mainly to teach basic numeric skills (in Artefact 1) and names of vegetables (in Artefact 2). In Artefact 1, there was a structure provided at the beginning of the E-book to guide the children and positive/negative feedback was also included. These elements indicated that a pedagogical concept was integrated into the design of the E-book, though the learning process was simplistic and objectivist-oriented. In Artefact

2, there was a guide at the beginning of the E-book to justify its content and usage, but it was unclear which pedagogical concept influenced the way the learning content was sequenced and presented in the E-book. . It would have been useful if both project documents had described the pedagogical approaches that would be exemplified in the design of the instructional materials.

There was also a lack of interactivity in the design of both E-books – children who were targeted to use these E-books would not experience flexibility in the content presentation, as they were only expected to click the "next page" button each time they want to move forward in the E-book. It would be useful to see interactive elements such as providing space for users to type their own responses within the E-book and annotating text within the E-book.

Based on the syllabus, technology played a more important role in the creation of the E-book than the subject matter content and pedagogical theories. In the interviews, the student teachers revealed the emphasis of their assignments was on the technology knowledge that they acquired from the course. As the student and teacher educator interviews were conducted as the students were working on these E-books in the class session, the students spoke about how they were working to build in graphics and sound files into their PowerPoint slides to make the E-book "interactive" and "user-friendly." Both artefacts illustrated how these student teachers put their espoused theories into action. The E-book projects that they had submitted showed how content and pedagogical knowledge were negotiated within a technology-focused assignment. The E-book projects showed that, although all three main components of TPCK were addressed, the overlapping areas of TPCK were not integrated into the design of the project. The main components of TPCK were dealt with in a simplistic and cursory manner, and children who are intended to use these E-books may not learn and be challenged to use higher order thinking skills, because the designs of the lessons in both artefacts were primarily memory-based and objectivist-oriented.

9.6 Class Observation

The session observed was part of a 3-credit course titled "Computer Applications in Education", and the course was delivered in Malay. MSTE2 was teaching two class sessions each week and the researcher was invited by MSTE2to observe one two-hour session .

In the class session, students were instructed to work on their individual and group projects that required them to use MS PowerPoint. There was no instructional presentation carried out during the observed session.

The single learning activity during the session was the development of students' individual and group projects for the course. The course project was about building an E-book for pre-schoolers, and the students were asked to source their own materials to design and build their projects. The E-books were targeted at helping pre-schoolers learn the alphabet and recognise sounds of words within the plot of a story. The students were asked to use audio files and visual images to make their plots interesting. It was tricky for the researcher to document observations for the class session because there were no specific teaching and learning phases that took place in the three-hour session. For the most part, the students were left alone to mind their own work. TE2 went around the class to look at her students' work and she took individual questions from the students. At the time of the class observation, the course had run for more than four weeks since the semester began. MSTE2 informed the researcher that basic introductions to the applications listed in the course syllabus had already been covered in the first few weeks of the course.

9.6.1 Analysis of the Class Session

When the activities and communications in the class session are mapped onto the TPCK framework, they would be as represented in **Figure 9.6**.

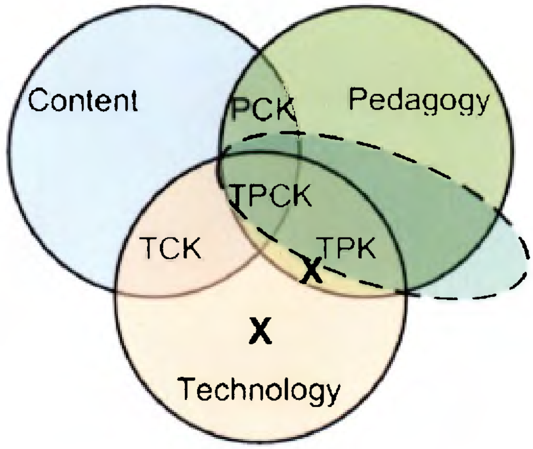

Figure 9.6: Mapping of Evidence from Classroom Observation onto the Adapted TPCK Framework (Case Study 2)

Analysing the course syllabus, it was clear that although there was a topic to be taught and learnt in the session, there was no evidence of any teaching being done during the observed session. When analysing the classroom activities and interactions, to see if Content Knowledge was addressed in the session, there was no interaction or specific learning action that took place between MSTE2 and the students, or among the students and their peers, that indicated any obvious focus on issues regarding content knowledge.

Technology knowledge (TK) was evidently the focal point of the session. The student teachers were highly attentive in working on their individual projects and most did not seem to require much attention or assistance from their course instructor (MSTE2). The instructor made rounds in the classroom and looked closely at the work of those she considered needed support. However, it was not clear if Technology Knowledge (TK) was dealt with in relation to Content Knowledge (CK) or Pedagogical Knowledge (PK). As the students developed their E-books, they seemed to be more concerned about the technical features of the project, rather than the content or pedagogical constructs of the project. For instance, during the class, with permission from MSTE2, the researcher asked a few students in the class about their strategies to develop their E-book projects. The students loosely described some deliberation on their part to include elements of learning theories that they have learnt in a different course. In their descriptions of the elements they were embedding into their E-books, the students used terms such as "interactive," "colourful graphics," "different font size and colours," and "copying pictures from CDs." When probed further, the students also revealed that in the course they did not learn explicitly about integrating elements of learning theories into the design process of course projects.

There was unclear evidence that TPK was addressed in the lesson. Students were asked to use a lesson plan template that students had to complete while working on their E-book projects. In the interview with TE2 earlier, she mentioned that the use of Instructional Design steps (using the ADDIE model) was proof that Pedagogical Content Knowledge was dealt with in the course. During the class session, the lesson plan template was used by the student teachers to build the content of their projects. MSTE2 constantly checked on their progress by looking at their lesson plan templates during the observed class session.

Table 9.6:

Analysis Table for Class Observation (Theories-in-Action)

Knowledge Type	Evidence of Practice/Existence	Status
Content Knowledge	None presented	Nil
Pedagogical Knowledge	None presented	Nil
Technological Knowledge	Main content in course assignment	Present
Pedagogical Content Knowledge	None presented	Nil
Technological Content Knowledge	None presented	Nil
Technological Pedagogical Knowledge	Expectation of course assignment	Present
	Use of lesson plan template	
Pedagogical Technological Content Knowledge	None presented	Nil
Constructivism in CK	None presented	Nil
Constructivism in TK	None presented	Nil
Constructivism in PK	None presented	Nil
Constructivism in PCK	None presented	Nil

Constructivism in TPK	None presented	**Nil**
Constructivism in TPCK	None presented	**Nil**
Constructivism	None presented	**Nil**

9.6.2 Summary of the Class Session

Data revealed that the knowledge types in the Adapted TPCK framework had not been addressed in the class session observed. Similarly to MSTE1's class, TE2's session had Technology Knowledge taking centre stage. A *laissez faire* approach was used by TE2 in the session observed. There was no instructional delivery presented by TE2. The class time was allocated for students to work on their assignments for the course.

The classroom interactions and behaviours did not indicate depth of understanding about principles of Constructivism or any learning theory that could guide them through the students' E-book production process. There was also no evidence that Constructivist principles were addressed in the session. Although the students had used jargon commonly related to Constructivism, there was no evidence of Constructivism being integrated into the instructional delivery of the lesson. There was no evidence of scaffolded instruction for students to build on their comprehension about the scope of the course in the observed session.

In the next chapter, data from the third case study is presented and analysed to provide another perspective on how Educational Technology was taught and learned at University Z.

Chapter 10: Main Study - Case 3

10.1 Introduction

This chapter presents the third and final case study compiled during the Main Study phase. Case Study 3 consists of data from another instance of an Educational Technology course taught by the teacher educator (MSTE3) to a group of students who specialised in various majors, including TESL, Mathematics and Science Education.

Due to contextual limitations, data was acquired only from one class observation and a selected number of classroom artefacts. Permission was not granted to interview any participant for Case Study 3. However, the researcher was given access to observation of one of the class sessions that was running during the academic semester (only one class session was scheduled per academic week). MSTE3 gave permission to view student projects that were shared online. The student projects were used in this study to represent learning products (theories-in-action) from the Educational Technology course over the entire semester.

The course descriptions and student projects were available on a course website and the researcher was given permission to access the course materials on the website. The assignment descriptors for course projects were analysed to represent the espoused theories that underlie the instructional approaches and strategies used by MSTE3 in this Educational Technology course.

According to MSTE3, this Educational Technology course was designed to address issues about technology and innovation, specifically how those issues are addressed within a school context. The student teachers were taught Instructional Design, particularly in integrating technology effectively into lesson designs. The students enrolled in the course were from various majors and they were asked to use their own understanding of their subject matter disciplines to create lesson plans that would incorporate the use of ICT effectively.

The course assessment consisted of two elements, similar to the previous two case studies reviewed in this study, formative (60% of total grade), and summative. Below is the breakdown of formative assessments designed for the course (each assignment carried 20% of total grade).

- Assignment 1 – The first assignment centres on the use of interactive whiteboards (IWB). Students were required to work collaboratively in groups of four, to create a lesson plan using the interactive whiteboard as the main technology tool for the lesson. The lesson was to be targeted at primary school level. Students were allowed to choose any learning content to build their lesson design. Technical demonstrations were provided during class sessions to help students learn to use interactive whiteboards for their assignments.

- Assignment 2 – The second assignment required students to create a personal blog to record their learning experiences in the class. Each student blog consisted of entries about class sessions and assignment processes that the student went through. All blogs were linked to the class resource website.

- Assignment 3 – The final assignment required students to create a PowerPoint presentation on computer lab management. Students worked in groups to prepare and present their slides (maximum three slides) to the rest of the class during class time. They were also asked to upload their presentation themselves onto the class resource website.

The summative assessment is a written final examination, which was held at the very end of the course. The final examination carried 40 percent of the course grade.

10.2 Analysis of Assignment Descriptors

TE3 provided written descriptions of two class projects that the student teachers would have to complete in the course (see Appendix F). The descriptions were mapped onto the adapted TPCK framework to identify how the adapted TPCK components were addressed from the point of view of TE3.

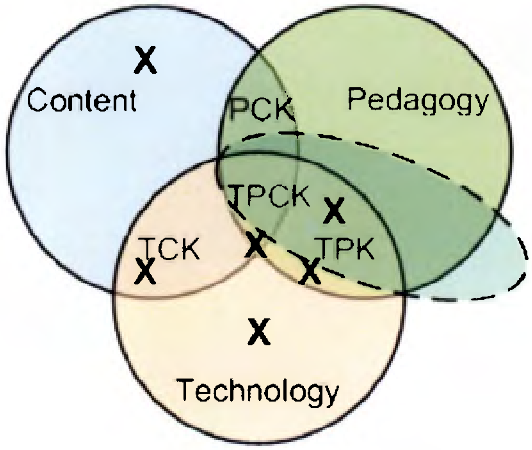

Figure 10.1: Mapping of Content of Assignment Descriptors onto the Adapted TPCK Framework (Case Study 3)

Figure 10.1 illustrates the types of teacher knowledge as they are espoused in the course project descriptions. The evidence, as described below, was clear.

a) CK – the students had to make a choice between English and Mathematics learning content. The content was to be taken from a primary school level textbook.

b) PK – Learning theories were to be referred to closely while students designed and developed their course projects. Though there was no mention of any specific pedagogical theory to be used, the students were asked to refer to their previous courses on Pedagogy, to guide them in the instructional design process for the projects.

c) TCK – the students were asked to pick suitable content that could be presented using the technology medium and students were shown samples of previous work that had utilised appropriate content for the technology tool assigned (in the case of the projects, the technology tool was the Interactive White Board (IWB)).

d) TPK - the project required them to consider suitable learning theories that would help engage students to learn using IWBs.

e) TPCK – the project also required the students to consider the appropriateness of selected content, learning theories and the potential of the IWB. It also asked students to think about strategies to modify and adapt content presentation to suit the learning theories they had chosen and match them to the tools on the IWB.

f) Constructivism – Students were encouraged to work collaboratively, particularly in building their projects. At the same time, they were asked to keep an individual blog to record their own learning experiences.

g) Constructivist TPK –The student blogs were reflective journals of their learning experiences in the course. The students were asked to share their blogs with the rest of the class. They were encouraged to comment on each other's entries, so they would be able to learn from each other's experiences.

h) TK – The primary technology tool was the IWB. Strong emphasis was put on getting students to learn all the features and tools available in the IWB. Students were also given opportunities to learn about various ICT tools in small hands-on sessions during class time, to make sure they are competent in handling the tools when teaching in real classrooms in the future.

It was evident in this course that there was an attempt to incorporate almost all of the teacher knowledge elements into the design of the class projects. As this course was intended for the training in using technology, from the scope of expectations described in the project descriptions, it is apparent that these student teachers are required to be able to combine the three core components (Content, Technology and Pedagogy) effectively into material design and development. It is noteworthy that this was the first time in this research that any teaching and learning activity has addressed TPCK (the key area in the TPCK model) in its content.

Table 10.1:

Analysis Table for ST1-2's Narratives (Espoused Theories)

Knowledge Type	Evidence of Practice/Existence	Status
Content Knowledge	English/Mathematics learning content was used	Present
Pedagogical Knowledge	Instructional design process was expected to consider pedagogical principles	Present
Technological Knowledge	None presented	Nil

Pedagogical Content Knowledge	None presented	Nil
Technological Content Knowledge	Course project requirement mentioned content should relate to use of technology	Present
Technological Pedagogical Knowledge	Course project requirement mentioned pedagogical aspects should be addressed in choice of technical tool	Present
Technological Pedagogical Content Knowledge	Course project requirement emphasised on considering relevance and suitability of content, pedagogy and technology in the project outcome	Present
Constructivism in CK	None presented	Nil
Constructivism in TK	None presented	Nil
Constructivism in PK	None presented	Nil
Constructivism in PCK	None presented	Nil
Constructivism in TPK	None presented	Nil
Constructivism in TPCK	None presented	Nil
Constructivism	Requirement to collaborate with peers to complete course projects	Present

In the next section, the artefacts submitted by students in the course will be analysed, to see if the intended learning goals were achieved in the students' work.

10.3 Class Artefacts

Two class projects are chosen for analysis- the uploaded Assignment 2 and the student blogs.

10.3.1 Analysis of Artefacts

MSTE3 provided access to the class resource website and the researcher had permission to select assignments for analysis from those which had been uploaded online. There was a selection of student work for Assignments 2 and 3. Examples were selected at random for review in this study. There were no assessment descriptors provided to indicate how the evaluation process was designed for each student assignment.

10.3.1.1 Class Artefact 1

The following are analyses of five student submissions for Assignment 2, which were individual blogs to record students' learning experiences in using technology in the course.

a) **Student Work 1** – The blog was written by student A, who was experiencing her first IT in Education course, and was coming to terms with the expectations of the course. The entries were written in letter format. Each entry expressed personal takes on the new things that student A was learning from the course. At the end of each entry, student A tended to give advice and pointers to her blog's audience. Though the blog was meant as a reflective tool for the students, student A did not demonstrate critical reflections about her work in the course, and the blog was mainly used to narrate events that happened in the course to an audience that she assumed was made of her classmates from the course. There was no comment recorded from anyone from the class in the whole blog.

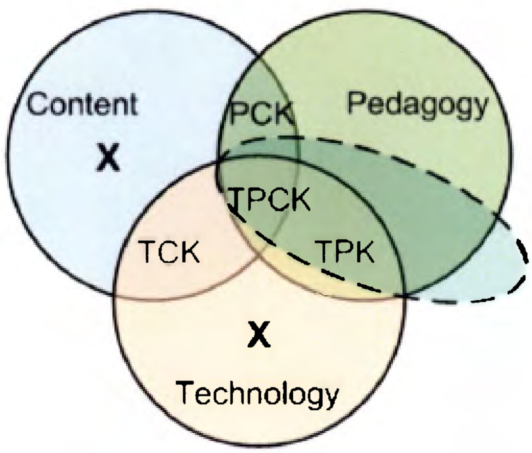

Figure 10.2: Mapping of Content from Student Work 1 onto the Adapted TPCK Framework (Case Study 3)

In **Figure 10.2**, only two knowledge types were present, Content Knowledge and Technology Knowledge. Content Knowledge was present in the descriptions in the blog. The blog discussed specific Subject Matter Discipline topics covered in the assignment. Technology Knowledge was utilised in the blog tools that were used to post her entries. Constructivism appeared to be neglected in this artefact.

b) **Student Work 2** – Student B took a more critical approach in writing her blog entries. She blogged diligently for seven weeks of the course. She tried to explain the things she learned from each week that she could use in her own classroom in the future. She explained what she thought about using an IWB and tried to relate her own classroom experiences to the strategies for using the tool in her own classroom. She took cues from class demonstrations and discussions on Instructional Design models that would be appropriate to use when doing lesson plans that use IWB. Student B used these ideas to plan the strategies for completing assignment 3.

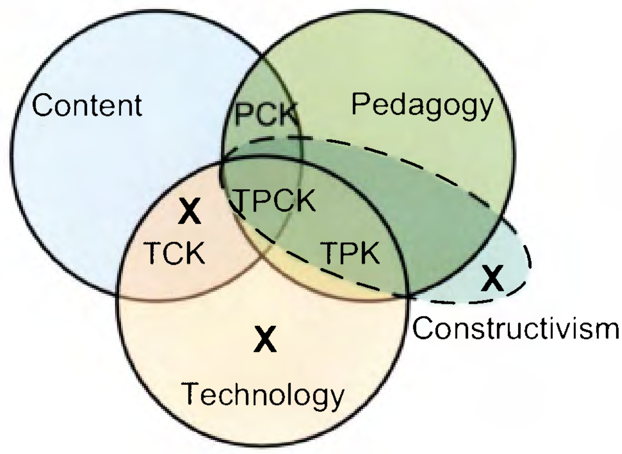

Figure 10.3: Mapping of Content from Student Work 2 onto the Adapted TPCK Framework (Case Study 3)

In **Figure 10.3**, three knowledge types were presented, TCK, TK and constructivism. Technology Content Knowledge was evident in that all blog entries were centred on her reflections on her understanding of how to use technology with appropriate pedagogical strategies embedded in the instruction. TK was evident because the student highlighted her use of technology in the projects she was developing for the course. Constructivism was also present, because the student engaged in reflective thinking when writing her blog entries. She tried to document her personal learning about technology actively throughout the academic semester.

c) **Student Work 3** – Student C's blog was dominated by personal reviews of software applications that he was introduced to during the course. He discussed briefly the features in each application. He gave advice on how to use the applications in the classroom. One of his entries was on Teaching Models, where he made a comprehensive list of useful links that feature commonly used teaching models for technology integration. There was no evidence of critical reflection about the application of any of the tools or teaching models that he featured in his blog. The overall presentation of the blog appeared more useful as a resource website for ICT in Education than a personal blog of opinions about learning how to use technology in the classroom.

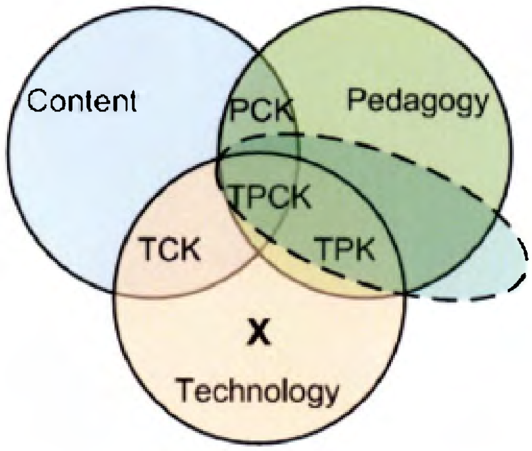

Figure 10.4: Mapping of Content from Student Work 3 onto the Adapted TPCK Framework (Case Study 3)

In **Figure 10.4**, only one knowledge type was present, TK. This blog was predominantly addressing TK. The student was evidently thrilled about learning new skills and tools in the course. He wrote recommendations on how to use the technology tools he learnt in the course, rather than writing reflectively about his experience. PK was addressed in that he did talk about a list of teaching models that would be useful for technology-integrated lessons.

d) **Student Work 4** – The blog entries by student D were personal in nature, as she tried to reflect on her role as a teacher as she learned about new technology tools in the course. She continuously affirmed her position as a teacher and the contributions she intended to make once she completed the whole teacher training programme. She appeared genuinely interested in using technology, though sceptical as to whether she would be able to carry out any technology-infused lessons if she taught in a school.

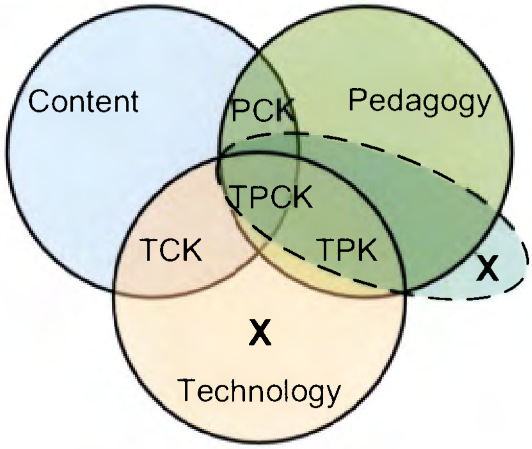

Figure 10.5: Mapping of Content from Student Work 4 onto the Adapted TPCK Framework (Case Study 3)

In **Figure 10.5**, only two knowledge types were presented, Technology Knowledge and Constructivism. TK was present in the blog entries because the student was evidently concerned about learning new technology skills in the course. The blog contained several entries about how she reflected on her role as a teacher and the challenge she faced as she learned about technology (evidence of reflective thinking, an element of Constructivism). Though she demonstrated reflective thinking in her entries, she did not associate it with Content Knowledge or Pedagogical Knowledge.

e) **Student Work 5** – Student E's blog entries were mainly made of cut-and-paste resources that he had found on the Web. The topics he looked at were those about the technology skills and tools that he had learnt in the course. Some of the entries began with his narratives about how his class for the week had gone and they ended with poems or tips and tricks which he acquired from external resources on the web. There was no evidence of critical reflection about the ideas or knowledge he picked up from the course. He did not publish his thoughts on the blog about using the applications he learned from the course in a classroom context.

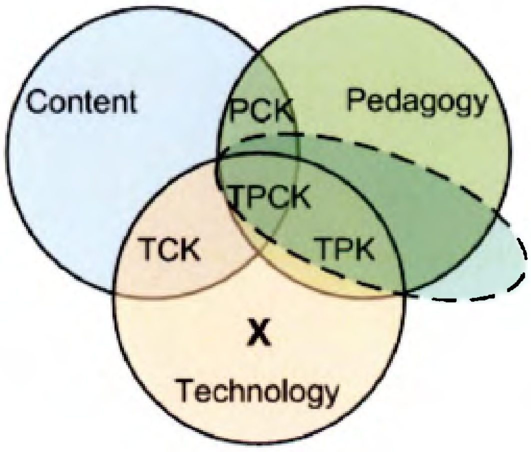

Figure 10.6: Mapping of Content from Student Work 5 onto the Adapted TPCK Framework (Case Study 3)

In **Figure 10.6**, only one knowledge type was presented, Technology Knowledge. There was no evidence of reflective thinking in the blog entries. The student concentrated on compiling as many TK resources as possible that related directly to the technical skills that he learned from the course.

When all of these maps (Student Work 1-5) are assembled into one cumulative map, the findings are depicted below in **Figure 10.7**.

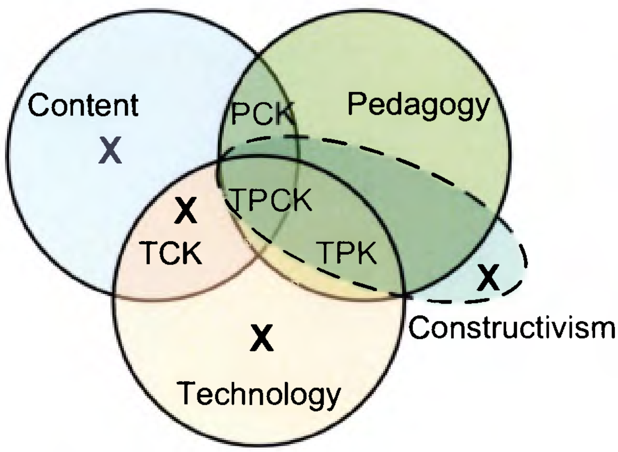

Figure 10.7: Mapping of Content from Student Work 1 – 5 onto the Adapted TPCK Framework (Case Study 3)

It is clear that most of the overlapping areas in the TPCK framework were not addressed in these student works, despite the fact that the assignment descriptors had evidently put forward the types of teacher knowledge that the students could integrate into the content of their work. In all of these blogs, the students constantly focused on TK, while other knowledge types lacked the same consistency and focus in the blog entries. The most significant finding is that none of the artefacts showed the student teachers addressing the central component in the conceptual tool, TPCK.

Table 10.2:

Analysis Table for MSST1&MSST2's Narratives (Espoused Theories)

Knowledge Type	Evidence of Practice/Existence	Status
Content Knowledge	Discussion on learning content in ST1's blog	Present
Pedagogical Knowledge	None presented	Nil
Technological Knowledge	Review of TK resources in all blogs	Present
Pedagogical Content Knowledge	None presented	Nil
Technological Content Knowledge	Descriptions of TCK in ST2's blog	Present
Technological Pedagogical Knowledge	None presented	Nil
Pedagogical Technological Content Knowledge	None presented	Nil
Constructivism in CK	None presented	Nil
Constructivism in TK	None presented	Nil
Constructivism in PK	None presented	Nil
Constructivism in PCK	None presented	Nil
Constructivism in TPK	None presented	Nil
Constructivism in TPCK	None presented	Nil
Constructivism	Use of reflective thinking in ST2&4's blogs	Present

The project has depicted how the students' espoused theories are put into action through the projects they were asked to complete during the course. From the initial three assignment descriptors, the students were provided opportunities to think about the learning content in the course. They were assigned to apply this in their lesson design assignment (particularly for Assignment 1). The blog assignment was also used as evidence to analyse whether Constructivism was taken into account in the design process of the assignment. Unfortunately, the students did not make full use of the technology tool. The students missed out on the opportunity to publish their critical reflective thoughts about their learning processes. Some did use the blogs to think about how technology affected their roles as teachers, while others talked about their personal reactions when learning to use new technology tools for designing teaching. However, the majority only narrated the events that happened in their class sessions. Some used the blogs as a platform to post creative writing excerpts that they found elsewhere on the web but they did not take the opportunity to publish original blog entries that would have presented their reflective thinking competencies. Thus, the overall trend of their theories-in-action is similar to previously presented case studies – the focus is mainly on Technology Knowledge.

10.3.1.2 Class Artefact 2

The following paragraphs describe and discuss the findings of three group projects for Assignment 3.

a) **Project 1** – Group A created an innovative plan for a computer lab set-up, where the furniture design was futuristic and ergonomically friendly. The slides showed a class plan of how the furniture would be arranged. It highlighted the importance of using the proposed furniture design as a strategy for maintaining eye-contact with everyone in the class.

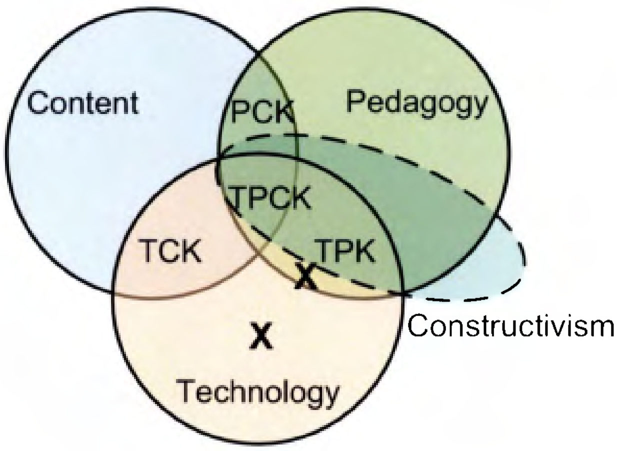

Figure 10.8: Mapping of Content from Project 1 onto the Adapted TPCK Framework (Case Study 3)

In **Figure 10.8**, only two knowledge types were presented, TK and TPK. TK was present because the project focused on the technical issues of setting up a computer lab, complete with floor plans which were drawn using drawing tools in the MS

PowerPoint application. TPK was evident as the students highlighted the importance of ergonomic practice in their computer lab design, signalling that they were conscious of making sure the technology design was accessible for the target user group.

b) **Project 2** – Group B created tables in a diamond-shaped design. They suggested that their proposal was the best solution for a teacher to monitor all student movements and maintain control in the computer lab.

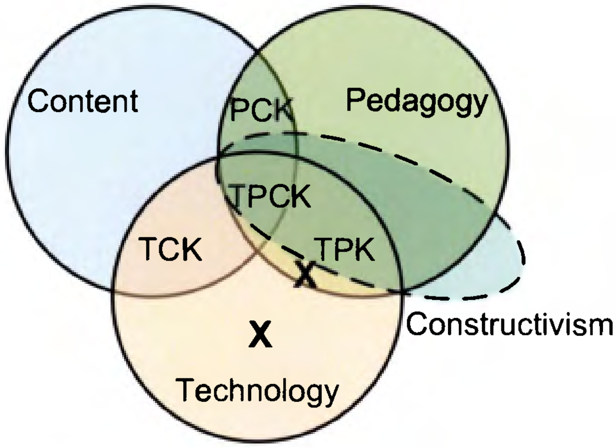

Figure 10.9: Mapping of Content from Project 2 onto the Adapted TPCK Framework (Case Study 3)

In **Figure 10.9**, only two knowledge types were presented, TK and TPK. TK was clearly addressed, as the students focused on creating a technology plan for a computer lab. TPK was evident in that the group tried to rationalise the use of their lab design as the best option for teachers to maintain eye contact while using technology tools in the proposed computer lab.

c) **Project 3** – Group C's computer lab design was more conventional, in that they proposed the use of long tables laid all around the four sides of the computer lab with one single round table in the middle of the lab. The justification for the proposed design was to provide maximum space for students and teachers to move about in the class. Everyone in the lab would be able to convene at the round table in the middle of the lab for any discussion task during class time.

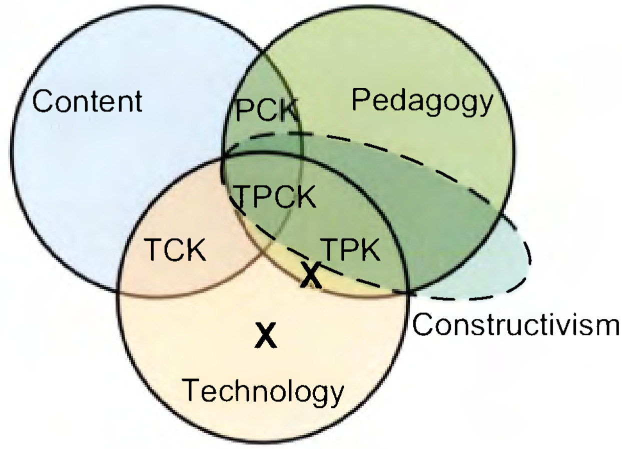

Figure 10.10: Mapping of Content from Project 3 onto the Adapted TPCK Framework (Case Study 3)

In **Figure 10.10**, only two knowledge types were presented, TK and TPK. Again, TK was evident in the project, because the students focused on optimising technology tools in a given space. They justified the use of technology based on their functionalities for the classroom. TPK was also present because the students also took into consideration the optimal amount of space the target user groups would require to work in their proposed computer lab plan.

When all three projects' contents are mapped onto the TPCK framework, they would be represented as shown below in **Figure 10.11**:

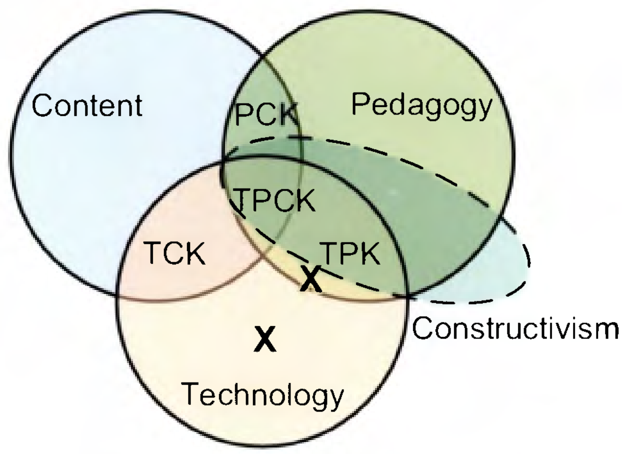

Figure 10.11: Mapping of Content of Student Projects 1 – 3 onto the Adapted TPCK Framework (Case Study 3)

Table 10.3:

Analysis Table for MSST1-2's Narratives (Espoused Theories)

Knowledge Type	Evidence of Practice/Existence	Status
Content Knowledge	None presented	Nil
Pedagogical Knowledge	None presented	Nil
Technological Knowledge	Use of technical knowledge in all projects	Present
Pedagogical Content Knowledge	None presented	Nil
Technological Content Knowledge	None presented	Nil
Technological Pedagogical Knowledge	Use of pedagogical elements to consider technical set-up in all projects	Present
Pedagogical Technological Content Knowledge	None presented	Nil
Constructivism in CK	None presented	Nil
Constructivism in TK	None presented	Nil
Constructivism in PK	None presented	Nil
Constructivism in PCK	None presented	Nil
Constructivism in TPK	None presented	Nil
Constructivism in TPCK	None presented	Nil
Constructivism	None presented	Nil

In Project 3, it is evident that the students did not consider the overlapping components as categorised in the TPCK framework. The assignment required them to propose a layout for a computer lab. They had to explain the justifications for their design. However, in the random samples reviewed for this study, the student projects did not reveal any evidence that subject matter content affected the way they planned for the set-up of a computer lab. Their justifications were, instead, centred on usability and ergonomic issues. It appeared that only when prompted, did the students look at the suitability of pedagogical elements with their proposed technology set-up, as seen for the second assignment (on creating individual blogs). Engagement in reflective thinking was not spelt out clearly in the instructions for Assignment 3.

Hence there was no evidence in the artefacts to suggest that the students considered using Reflective Thinking.

10.3.2 Summary

From the course syllabus, it was not clearly mentioned how overlapping between content knowledge, pedagogical knowledge and technology knowledge were addressed in the course. In their blogs, the students did mention samples of project documents, created by a previous batch of students. The projects were displayed in a few class sessions to illustrate the expectation of success for their class project. Similar to evidence acquired from Case Studies 1 and 2 previously, Technology Knowledge (TK) was emphasised in this Educational Technology course. Analysis of the course project descriptors did reveal evidence that pedagogical knowledge was addressed and considered in this Educational Technology course. However, it was not clear if other types of teacher knowledge were addressed in these student projects.

In developing the projects, the students did not have much opportunity to demonstrate their use and understanding of Constructivism in the assignments, even though the term "Constructivism" was used repeatedly in the class, student blogs, project descriptors and observed class interaction.

10.4 Class Observation

The class observed was part of a two-credit course on Technology & Innovation in Education. The class session was held in a multimedia room at the Faculty of Education, where about thirty students were present to attend the second class session for the course. The course focuses on the use of educational technology in the classroom. It is a 12-week course, which started a week before this class observation was carried out. Due to the constraints in the university's registry system, student attendance was still not finalised in the second week of the term. The class roster was not yet confirmed at the time of the class observation.

The curriculum for the students in this case study was different from those of Cases 1 and 2. The course was designed for graduates who were keen to take up teaching positions at secondary schools in the country. Part of the admission requirement was that students must already have obtained at least one Bachelor's degree in a field of their choice prior to enrolling into this nine-month teacher training diploma programme.

Upon completion of the Teaching Diploma programme, these student teachers would either teach Mathematics or English (Teaching of English as a Second Language) at secondary schools around the country. Such teacher training programmes were not the only government-driven initiative to encourage more people to acquire teaching certification so they would be able to join the teaching force in national schools in the country. Several similar programmes were also offered at other local universities to recruit pre-service and in-service teachers and new graduates who were interested in going into teaching. These programmes ranged from certificate level to Bachelor's degree level. Upon completion, those from the certificate and diploma levels would be posted to primary schools, and those with a Bachelor's degree would be posted to teach at secondary schools in the country.

The three-hour class session began with a formal lecture by the main course instructor in the first hour and a half of the class. This was followed by three different practical sessions with two teaching assistants for the rest of the class hours.

In the formal lecture session, the main course instructor spoke about strategies and ICT tools used to engage students in the learning process. With several comprehension check questions to recap the previous lecture content, the student teachers were guided to think about how they would personalise their students' learning processes using "new pedagogy." The lecturer presented real-world examples to the student teachers, highlighting her own research experiences in looking at how schools in the country were handling the use of technology in the classroom. Photos and anecdotes from her most recent research trips were used as talking points in the class discussion to lead the student teachers to talk about common learning problems faced by teachers.

The course syllabus explained that students were expected to learn about using and installing two different types of tools (the scanner and IWB), so they would be able to manage the use of these tools independently in their own classrooms later. In the class session, after the formal lecture, the session was divided into three shorter hands-on sessions, where students were asked to go into small groups and rotate from one session to another throughout the rest of the class session. The first hands-on session dealt with the use of selected hardware, such as laptops, LCD projectors, printers, scanners, digital cameras, and the interactive whiteboard. In the second hands-on session, the student teachers were taught how to use the Internet to search for specific information, in this case, to look for appropriate driver websites that can be used to install the ICT tools introduced in the earlier part of the class. The final hands-on session focused on introducing the student teachers to using a Yahoo Group website for the course (which was used as the primary online medium to assemble class resources and post messages to the class). The student teachers were also introduced to the concept of blogging, in which they were each asked to create their personal blogs for the purpose of this course.

10.4.1 Analysis of the Class Session

When the activities and communications that took place in this class session are mapped onto the TPCK framework, they would be represented as in Figure 10.12 below.

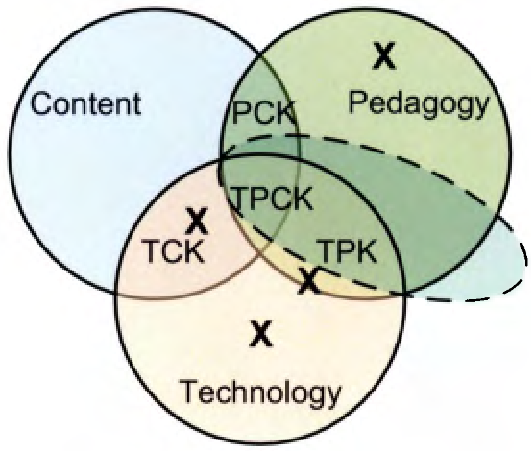

Figure 10.12: Mapping of Evidence from Classroom Observation onto the Adapted TPCK Framework (Case Study 3)

In **Figure 10.12**, four knowledge types were presented: PK, TK, TCK and TPK. The first part of the class session mainly addressed Pedagogical Knowledge (PK). This was obvious because the one and half hour lecture included all the topics deemed relevant to enable the student teachers to understand the concept of "engaged learning." Samples of good and bad practices of learning with technology were shared with the class, to illustrate how important it was to internalise this concept into any teaching and learning process. The practical sessions in the class covered the technical aspects of selected ICT tools, as represented by Technology Knowledge (TK) and Technology Content Knowledge (TCK) in the TPCK framework.

There was some evidence of dealing with TPK captured in the lecture session, when the course instructor spoke briefly about the need to look into the pedagogical aspect of technology, instead of just focusing on the technical knowledge of ICT tools. The instructor described her experiences in invigilating schools across the country, which had been given the technology budget, but have yet to demonstrate improvements in quality of teaching and learning for both students and teachers. She also showed pictures from her field trips to remote schools and she explained how technology has been misused in many classrooms across the country. She therefore stressed the need to learn about using technology effectively to promote better learning for school children. Though the instructor's lecture addressed a form of TPK, there was no mention of any learning theories or frameworks associated with TPK.

In the hands-on sessions later in the class session, there was also no evidence of pedagogical theories or frameworks when the class handled the technology equipment and software presented in the sessions.

The map above illustrates gaps in addressing teacher knowledge in the class session, as evidenced in the class observation. There were no interviews conducted with the teacher educator or her student teachers. It was not possible to generalise findings from a single classroom observation to the entire course. Evidence from this particular class observation provided a broad idea about how this educational technology course was designed, managed and implemented, particularly for the "Engaging Learning" topic. The class session went on for more than four hours, and it was clear that the bulk of the content was about mastery of technical knowledge of selected ICT tools. For two-thirds of the class session observed, the student teachers were given the opportunity to learn to use selected ICT tools in small groups (two teaching assistants managed two large groups of students of about fifteen each). Students were encouraged to touch, use and troubleshoot each ICT tool provided in the Multimedia Room. The students showed the most interest in using the Interactive Whiteboard which dominated the entire room, because it was placed at the front and was used initially in the lecture session by the course instructor. Students were assigned small tasks to orientate them to using each tool, a useful instructional strategy to make them lose their personal fears about using technology tools.

From the list of content topics described in the course syllabus, the evidence presented an inclination toward providing opportunities to learn to master Technology Knowledge in these Educational Technology courses. There was evidently little emphasis on pedagogical development in using ICT in this course, with the possible exception of one topic on "Instructional design and technology", which would be presented in Week 6 of the twelve-week course.

Table 10.4:

Analysis Table for ST1-2's Narratives (Espoused Theories)

Knowledge Type	**Evidence of Practice/Existence**	**Status**
Content Knowledge	None presented	Nil
Pedagogical Knowledge	Focus of lecture on "Engaged Learning"	Present
Technological Knowledge	Focus on hands-on session in class	Present
Pedagogical Content Knowledge	None presented	Nil
Technological Content Knowledge	Demonstration on use of TCK with IWB	Present
Technological Pedagogical Knowledge	Mentioned in lecture	Present
Pedagogical Technological Content Knowledge	None presented	Nil
Constructivism in CK	None presented	Nil
Constructivism in TK	None presented	Nil
Constructivism in PK	None presented	Nil
Constructivism in PCK	None presented	Nil
Constructivism in TPK	None presented	Nil
Constructivism in TPCK	None presented	Nil
Constructivism	None presented	Nil

The map above also showed a lack of evidence of Constructivist principles, either as a topic of a learning task or in-class discussion. During the class, the course instructor quoted Merrill's *Pedagogy of Engagement* (Merrill, 2001). She explained how important it was to integrate instructional design knowledge in the use of educational technology. The absence of focus on Constructivism in this course might have been, in effect, because of the objectivist nature of Merrill's instructional principles, which were clearly adopted in this course. However, in the course syllabus, one of the learning goals listed was developing the student teachers' competencies in critical thinking, collaborative work and problem-solving. These aspects could be categorised as constructivist elements in the course, but in the lesson observation, there was no evidence of such elements being used.

10.4.2 Discussion

The class observation provided a useful insight into how another educational technology course is taught in University Z, by MSTE3, to a different group of student teachers. Different instructional strategies and activities that took place for the four-and-a-half hour class illustrated how technical knowledge of technology dominates the syllabus of the course, which was designed to equip these non-education-major student teachers, within a nine-month training timeframe, to implement and manage educational technology in their own classrooms. Pedagogical Knowledge and Technological Pedagogical Content knowledge seemed to be overlooked, though in the course syllabus there was mention of a topic on Instructional Design and Technology. Though elements of Constructivism were mentioned in the learning objectives, this was not explicitly mentioned or designed into any of the class activities or discussions in the class session observed. From the class interactions and activities, it was not obvious that Constructivist principles have influenced the way the educational technology course is designed. Student teachers in the course were required to write and maintain a personal blog throughout the course, to provide an opportunity for reflection, but the rationale was not explicitly explained to the student teachers. Overall, the class session provided a chance for the students to become acquainted with ideas about teaching using technology and to learn how to use selected ICT tools, but without any obvious link to pedagogical elements when using technology to teach specific content.

10.4.3 Summary

This chapter has looked at another Educational Technology course at University Z. All examples collected from this case study showed an emphasis on Technology Knowledge. The choice of focus might have been simply a practical issue of needing to do the necessary. This case study has shown the possibility to use the adapted TPCK framework to categorise classroom beliefs and practices. Although the data analysis may not have illustrated use of all knowledge types identified in the TPCK framework, the experience from the data analysis process has shown the current pattern of practice in the teaching and learning of Educational Technology at University Z.

A synthesis and discussion of the findings from these three cases is presented in the next chapter.

Chapter 11: Main Study - Synthesis of Findings

11.1 Introduction

The case studies presented in the last three chapters have uncovered interesting issues regarding the treatment of Teacher Knowledge and Constructivism in Educational Technology courses taught at University Z's teacher education programme. Each case brought unique perspectives to how the teaching and learning of Educational Technology was conceptualised, implemented, assessed and reflected upon by the teacher educators and their students. In this chapter, the overall findings are synthesised and discussed to respond to the research questions of this thesis.

11.2 Analyses of Findings

The main study findings revealed interesting patterns of espoused theories and theories-in-action as perceived, narrated and acted out by the participants of this study. The conceptual tool which was used in this research provided a means to systematically map the data. The data was then mapped cumulatively in another graphical format to understand the consistencies and discrepancies between what was said and what was done in the three case studies.

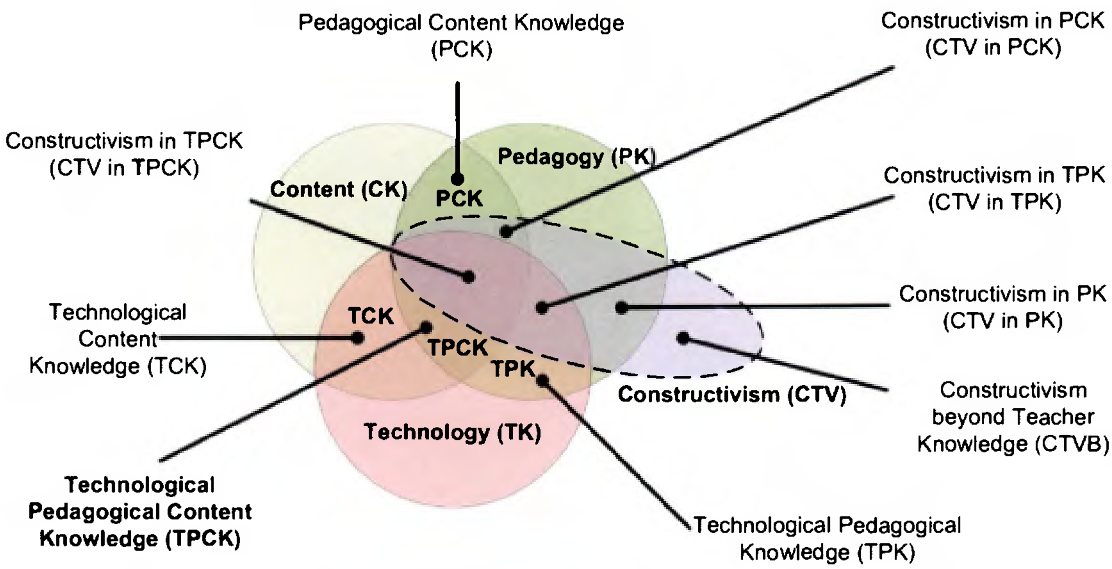

Figure 11.1: Adapted TPCK Framework

11.2.1 Use of a Binary Approach to Data Classification

When analysing the case studies, decisions had to be taken about what kinds of interpretations could be justified, given the data available. The presence of data was taken to justify a claim that something had happened. However, the amount of data was not seen as a good indicator of the prevalence of something, since different sources were being considered (assignments, interviews, documentation) and it was not clear what kinds of generalisations would be appropriate, given these different sources. There was also no way of identifying norms or upper bounds on the amounts of data. This made it impossible to establish the *frequency* or the *degree* to which something was present. For these reasons, a simple classification scheme was used – one that could easily be defended – which simply noted whether there was or was not evidence of particular kinds of knowledge being demonstrated. This binary classification formed the basis for claims that certain kinds of knowledge were addressed within courses, or that there was no evidence for them being addressed.

To decipher the presence and absence of data for the twelve sectors of the adapted TPCK framework, a binary matrix table was used. The table represents all twelve sectors in the Adapted TPCK framework, so that the presence, and absence, of each knowledge type in each case study conducted. One column specifies whether the data arose in relation to Espoused Theories (interviews) or Theories-in-Action (practices). The table display is thus crucial in illustrating the presence of each knowledge type in the teaching and learning of Educational Technology courses within these teacher education programmes.

The decision to use the table instead of marking the sectors within the adapted TPCK figure was based on an earlier trial of the framework. This sought to indicate the frequency of evidence within each sector in the adapted TPCK framework. The framework became cluttered when marked. It was also impractical to illustrate comparisons of data from each case study, in relation to the Espoused Theories and Theories-in-Action categories, because using the adapted TPCK framework would not allow for a multi-dimensional presentation of data.

Using the binary table also enabled an explicit display of data consistency for each category of data source. For instance, in Table 11.1, drawing conclusions based on the binary marking for each Knowledge aspect in the Adapted TPCK framework is straightforward and systematic. By reviewing the rows within each table, the consistency of the presence and absence of data for each case study analysed can simply be 'read off' by looking for gaps.

11.2.2 Absence and Presence of Evidence using Binary Approach

The following are discussions on each case study, using the binary table to display the presence and absence of data in each category described earlier in the Adapted TPCK framework.

Table 11.1:

Mapping of Data from Case Study 1

	Type	CK	PK	TK	PCK	TCK	TPK	TPCK	CTV in TPCK	CTV in PCK	CTV in TPK	CTV in PK	CTVB
Teacher Educator Interview	Espoused	X	X	X	X	X	X	X	X	X	X	X	X
Student Teacher Interviews	Espoused			X			X						X
Course Projects	Action			X									
Class Observation	Action	X		X									
Consistent?		**Y**	**N**	**YA**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**

Legend:

X — *Exists in at least one instance observed*

Y — *Yes – exists in one or some instances observed*

YA — *Yes – exists consistently in all instances observed*

N — *Nil – gap exists in one or some instances observed*

In the first case study, the most consistent evidence of addressing the many types of teacher knowledge is for Technology Knowledge (TK). This is evident and observable for both espoused and theories-in-action for all instances observed in Case Study 1. The findings also revealed that espoused theories of both teacher educator and his students were inconsistent with findings acquired from selected course projects and class observation.

The teacher educator's espoused theories about dealing with teacher knowledge in his Educational Technology course were more extensive than those expressed by his own student teachers who were interviewed in this study.

Evidence of teacher knowledge was also less obvious in the observed learning event and artefacts examined for this case study.

The consistent phenomenon illustrated by evidence in the study was that TPCK was not addressed in practice. Though the teacher educators believed that it was dealt with in their Educational Technology courses, there was no evidence of action or artefact to corroborate the narratives.

It was also espoused in both teacher educator interviews that Constructivism was incorporated into the Educational technology course. However the learning artefacts and class observation did not substantiate the claims

Table 11.2:

Mapping of Data from Case Study 2

	Type	CK	PK	TK	PCK	TCK	TPK	TPCK	CTV in TPCK	CTV in PCK	CTV in TPK	CTV in PK	CTVB
Teacher Educator Interview	Espoused	X	X	X	X	X	X	X	X	X	X	X	X
Student Teacher Interviews	Espoused		X	X								X	X
Course Projects	Action	X	X	X	X		X						
Class Observation	Action	X	X	X			X						
Consistent?		Y	YA	YA	Y	N	Y	N	N	N	N	N	N

Legend:

X *Exists in at least one instance observed*

Y *Yes – exists in one or some instances observed*

YA *Yes – exists consistently in all instances observed*

N *Nil – gap exists in one or some instances observed*

In the second case study, the pattern of findings is similar to those obtained in the first case study. The mapping showed that the Educational Technology course evidently addressed Technology Knowledge and Pedagogical Knowledge. In the narratives, the teacher educator insists that since the students were using "some sort of content" to work on their projects, Content Knowledge was adequately addressed in the course. However, her students, interestingly, did not indicate similar perceptions.

In the overlapping areas in the TPCK framework, several teacher knowledge types appeared to be consistently absent from the data acquired from interviews, artefacts and learning events observed for this case study. TPCK was clearly "nonexistent" in the theories-in-action evidence analysed in the study. Constructivism was mentioned in the interviews with both teacher educator and the students, but there was no data to corroborate its existence in practice.

Table 11.3:

Mapping of Data from Case Study 3

	Type	**CK**	**PK**	**TK**	**PCK**	**TCK**	**TPK**	**TPCK**	**CTV in TPCK**	**CTV in PCK**	**CTV in TPK**	**CTV in PK**	**CTVB**
Assignment descriptors	Espoused	X	X	X		X	X	X			X		X
Course Project 1	Action	X	X	X		X						X	X
Course Project 2	Action			X								X	
Class Observation	Action		X	X		X	X						
Consistent?		Y	Y	YA	NA	Y	Y	N	NA	NA	N	Y	Y

Legend:

X	*Exists in at least one instance observed*
Y	*Yes – exists in one or some instances observed*
YA	*Yes – exists consistently in all instances observed*
N	*Nil – gap exists in one or some instances observed*
NA	*Nil – does not exist consistently in all instances observed*

In Case Study 3, Technology Knowledge is the only teacher knowledge type which was consistently addressed in all four instances of learning artefacts and events. Though there was no interview data captured for this case study, the assignment descriptors sufficiently illustrated how the learning of Educational Technology in this course was designed. It is also evident from the table above that TPCK was not evident in the course artefact and the class session observed. Constructivism seemed to be included in the work carried out by students. Though the instructions in the assignment descriptor suggested the use of Constructivism within the application of Technological Pedagogical Knowledge, students were able to put Constructivist elements into the pedagogical design of their projects. As with the previous case studies, this case illustrates that the overlapping areas of teacher knowledge are not taken up either as an espoused theory or as a theory-in-action in this Educational technology course.

When all the maps are integrated, the analyses for each case study are clearly illustrated, as seen in the series of tables below.

Table 11.4:

Presence of CK in the Educational Technology Courses

	Espoused Content Knowledge			**CK-in-Action**		
	Case 1	**Case 2**	**Case 3**	**Case 1**	**Case 2**	**Case 3**
Teacher Educator Interview	Present	Present				
Student Teacher Interviews	Nil	Nil				
Course Projects			Present	Nil	Present	Present
Class Observation			Present	Present	Present	Present

Content Knowledge (CK) was claimed to be present in the teaching and learning of Educational Technology, by both teacher educator and students in these three courses. However, the table above reveals that in the first two case studies, it was not present in practice. In Case Study 3 however, it was consistently present, both in perception and in action.

Table 11.5:

Presence of PK in the Educational Technology Courses

	Espoused Pedagogical Knowledge			**PK-in-Action**		
	Case 1	**Case 2**	**Case 3**	**Case 1**	**Case 2**	**Case 3**
Teacher Educator Interview	Present	Present				
Student Teacher Interviews	Nil	Present				
Course Projects			Nil	Nil	Present	Nil
Class Observation			Present	Present	Nil	Present

Though Pedagogical Knowledge (PK) was believed to be addressed in these Educational Technology courses, the evidence from the collected data did not illustrate the use of PK in the courses, except for one piece of evidence in Case Study 2.

Table 11.6:

Presence of TK in the Educational Technology Courses

	Espoused Technological Knowledge			TK-in-Action		
	Case 1	**Case 2**	**Case 3**	**Case 1**	**Case 2**	**Case 3**
Teacher Educator Interview	Present	Present				
Student Teacher Interviews	Present	Present				
Course Projects			Present	Present	Present	Present
Class Observation			Present	Present	Present	Present

Technology Knowledge (TK) was consistently espoused and performed in all narratives, class artefacts and observed class sessions in all instances captured in this research. TK might have been the main emphasis in these Educational Technology courses because of the nature of these course, being a training course to use technology in the classroom.

Table 11.7:

Presence of PCK in the Educational Technology Courses

	Espoused Pedagogical Content Knowledge			PCK-in-Action		
	Case 1	**Case 2**	**Case 3**	**Case 1**	**Case 2**	**Case 3**
Teacher Educator Interview	Present	Present				
Student Teacher Interviews	Nil	Nil				
Course Projects			Nil	Nil	Present	Nil
Class Observation			Nil	Nil	Nil	Nil

PCK is the area which Shulman (1987) identified as crucial in a teaching process. In the main study, it was clear that both teacher educators presumed that PCK was addressed in their respective courses. However PCK was only detected in the student projects which were developed by student teachers in Case Study 2. PCK was visibly lacking in the instructional delivery phase of lessons observed for all three cases, and it was clear that these teacher educators neglected to include PCK in actual lessons in their courses. None of the student teachers interviewed picked up the presence of PCK in their lessons.

Table 11.8:

Presence of TPK in the Educational Technology courses

	Espoused Technological Pedagogical Knowledge			**TPK-in-Action**		
	Case 1	**Case 2**	**Case 3**	**Case 1**	**Case 2**	**Case 3**
Teacher Educator Interview	Present	Present				
Student Teacher Interviews	Present	Nil				
Course Projects			Present	Nil	Present	Nil
Class Observation			Nil	Nil	Present	Present

TPK represents the amalgamation of technology knowledge and pedagogical knowledge. In the teacher educator interviews, there were clear claims that TPK was addressed in the Educational Technology courses. However, only students from the first case study indicated that they perceived TPK was addressed in their Educational Technology course. Evidence from the course showed that TPK was not present in the application components of the course. In Case Study 2, TPK did appear to be used in the class projects and instructional delivery phase, though none of the students interviewed was able to recognise evidence of TPK in the course. In Case 3, the assignment descriptors did address TPK but it was not found in the actual course projects themselves.

Table 11.9:

Presence of TCK in the Educational Technology Courses

	Espoused Technological Content Knowledge			**TCK-in-Action**		
	Case 1	**Case 2**	**Case 3**	**Case 1**	**Case 2**	**Case 3**
Teacher Educator Interview	Present	Present				
Student Teacher Interviews	Nil	Nil				
Course Projects			Present	Nil	Nil	Nil
Class Observation			Present	Nil	Nil	Present

Though Technology Knowledge was present in all instances observed in these courses, Technological Content Knowledge did not yield similar results. It was not present in any of the course projects analysed for this research.

Table 11.10:

Presence of TPCK in the Educational Technology Courses

	Espoused TPCK			**TPCK-in-Action**		
	Case 1	**Case 2**	**Case 3**	**Case 1**	**Case 2**	**Case 3**
Teacher Educator Interview	Present	Present				
Student Teacher Interviews	Nil	Nil				
Course Projects			Nil	Nil	Nil	Nil
Class Observation			Nil	Nil	Nil	Nil

The table above succinctly illustrates the lack of emphasis on TPCK across all three courses at University Z which were observed for the purpose of this research. Though TPCK was perceived to exist in the courses by the teacher educators, there was no evidence of it in practice in any of the class artefacts and learning events observed in the three case studies. It is also obvious that narratives from the student interviews did not reveal any indication that TPCK was addressed in their Educational Technology course.

Table 11.11:

Presence of Constructivism in the Educational Technology Courses

	Espoused Constructivism			**Constructivism-in-Action**		
	Case 1	**Case 2**	**Case 3**	**Case 1**	**Case 2**	**Case 3**
Teacher Educator Interview	Present	Present		Nil	Nil	
Student Teacher Interviews	Nil	Present		Nil	Nil	
Course Projects	Nil	Nil	Present	Nil	Nil	Present
Class Observation	Nil	Nil	Nil	Nil	Nil	Nil

Table11.11 above shows the treatment of Constructivism in these Educational Technology courses. Although both teacher educators interviewed spoke about using Constructivism in their respective courses, there was only evidence of this in one instance, where it was stipulated in the Course Project descriptors and consequently was integrated into students' actual work. In Case Study 2, narratives by student teachers suggested that they believed Constructivism was addressed in their

Educational Technology course. However, when asked further if they could provide evidence of work or interactions, they were not able to substantiate their claims. Constructivism was only evident in the teacher educator narratives. The tables also show that in the analysis of Class Observations for all three case studies, none showed any proof that TPCK and Constructivism was espoused or brought into action in any form. However, all things considered, it was plausible that the students might have not been able to articulate their understanding during the interview and thus their narratives about Constructivism did not reflect what they essentially knew and learned in the courses.

11.3 Discussion

Findings of the main study are presented and discussed in the following section. This discussion has been organised to directly address each of the research questions for this thesis.

11.3.1 Research Question 1

> *What are the espoused theories and theories-in-action of teacher educators and student teachers that reflect their teaching and learning of Educational Technology courses?*

From the perspectives of teacher educators interviewed in this study, all components of the TPCK model are dealt with in the teaching of Educational Technology courses at University Z. However, the narratives from their student teachers, artefacts of student projects and learning events observed during class sessions contradicted these claims.

The data analysis also revealed that TPCK, the core element in the TPCK framework, was not observed in all instances in the three Educational Technology courses. Based on the perceptions of the students who were taking these Educational Technology courses, on the content of course projects they undertook, the knowledge types identified in the TPCK framework were not fully addressed in these courses. As a result there was no indication of the application of TPCK in any form of teaching and learning outcome or production for all three courses which formed the basis of this study.

Essentially, the study has revealed incongruence in how teacher knowledge was conceptualised and implemented in these courses. It also showed a pattern of overvalue among teacher educators, who claimed in the interviews that they have covered all components of teacher knowledge in their respective courses. There was also a pattern in practice of focusing on Technology Knowledge. This was evident in the narratives and artefacts collected from all instances in the three case studies.

Findings also implied emphasis on Technology Knowledge in the teaching and learning of these Educational Technology course.

Both pilot and main studies illustrated a pattern of misinterpretation of Content Knowledge. In several of the interviews, Content Knowledge was interpreted as any type of content used to teach any topic in the Educational Technology course. In the case of this research, Content Knowledge refers to the use of content from Subject Matter Disciplines, such Mathematics, Science and History. However, the respondents referred to Content Knowledge as the content of the Educational Technology courses they taught or learned. The occurrence illustrated the complex nature of compartmentalising knowledge about Educational Technology into categorisations which the participants were not familiar with.

Data also revealed that the overlapping knowledge types were not addressed in observed instances of this study. This pattern was consistent across the results of the pilot and main studies.

The analyses derived from the pilot and main studies also suggest there was also a possibility that the interviewees (both teacher educators and their students) were not able to communicate these concepts during the interview. The constraints of the interview sessions with the all participants might have been influenced the responses collected. In both studies, all participants did not know the TPCK jargon. They were only acquainted with the categories of knowledge when explained in the interview sessions. The phenomenon might have affected the way the participants answered the questions during the interview. The participants might have found it challenging to reflect and analyse what they learned or taught to match the jargon used in the TPCK framework.

There is also a possibility that the teacher educators have failed to communicate aspects of teacher knowledge to their students through their classroom instruction and tasks. They might have known the concepts but have associated them in different formats or categorisations. The phenomenon is consistent with Hashweh's perspectives (2005) about the nature of "knowing"; instead of having absolute ideas about knowledge of a concept, the participants might have an understanding about the concept that was still in the process of growth. Such in-progress phenomenon about thinking, understanding and knowing cannot be captured or represented using the TPCK framework, as this was one of its greatest limitations.

11.3.2 Research Question 2

What are their interpretations of Constructivism in their teaching and learning of Educational Technology?

Espoused Constructivism was discovered in the narratives of teacher educators and in only one of the interviews with a group of student teachers. In other teaching and learning instances observed for this study, no instance of Espoused Constructivism was recorded.

There was no evidence to prove that Constructivism-in-Action existed in the teaching and learning of Educational Technology in these three courses. However, in one of the course projects for Case Study 3, Constructivist elements were embedded into the assignment descriptor and, therefore, students duly used the proposed elements in their projects.

Throughout the interviews, there was clear evidence of misinterpreting Constructivism. What was described by the participants as Constructivism more closely resembled Behaviourism. There is a possibility that the respondents were more keenly aware of the basic tenets of Behaviourism rather than Constructivism. This may have affected the way they approach the application of Constructivist principles in their teaching and learning process.

It was also evident in both the pilot and main studies that student teachers did not have the opportunity to use and apply Constructivism to a significant extent in their projects, although all teacher educators interviewed claimed to have integrated

Constructivism into their Educational Technology courses. There is a possibility that the respondents attempted to respond to the interview questions to match what they thought the researcher was looking for. They may lack the skills to verbalise their own comprehension about Constructivism during the interview, and it is likely that Constructivism was not clearly articulated in the course projects and instructional delivery in class.

11.3.3 Implications

Insights about teacher knowledge within a teacher education setting are described below. Each is synthesised and discussed in the light of findings and claims reviewed in the literature.

11.3.3.1 Cursory Understanding about TPCK

It was claimed consistently that TPCK is used and applied in Educational Technology courses at University Z. However, data has shown that only parts of teacher knowledge were addressed in these courses. There were noticeable gaps between what was claimed and what was actually put into action. Although, to date, there has not been any documented effort to use the TPCK framework to map out elements of espoused theories and theories in action, this research has successfully established evidence of practice of how teacher educators view their own teaching beliefs and practices in dealing with the concept of teacher knowledge. When probed further to provide evidence of practice, it became clear that they had a cursory understanding of some elements of teacher knowledge, and how they should deal with TPCK in their courses. For instance, "instructional design" was understood as "an indication that pedagogical knowledge was addressed," and when asked for evidence of practice, one of the teacher educators claimed that the measure of practice was when he asked his students "to build lesson plans." When his students were interviewed, they revealed that they had been asked to use predetermined templates which were given out by the tutor as the basis to create "lesson plans" for their course projects. None of the students was able to describe the actual instructional design steps involved in designing a lesson plan, instead they just filled in the boxes in the templates and felt that this was sufficient proof that they had used Pedagogy Knowledge in their course projects.

The direct implication of the finding to the field of education is that the nature of learning about Educational Technology has to be revisited. The pattern in the data has illustrated a strong emphasis on learning about Technology Knowledge. With the adapted TPCK framework, it helps categorise the types of knowledge components which are needed to position an effective integration of technology into the classroom. The visual map helps to discern the different components of knowledge. It assists in recognising the differences between the main knowledge components and the overlapping components.

11.3.3.2 Mismatch between Teacher Educators' Claims and Actual Teaching Practice

Teacher educators tended to claim that they have covered all types of teacher knowledge in their teaching of Educational Technology. However, their students did not concur with that view. Class artefacts and observations also indicated a lack of consistency in the way teacher knowledge was addressed in these courses. The teacher educators also tended to describe their teaching role as "facilitator" and "guide on side," all of which conform to common jargon in Constructivist-oriented teaching. However, there was clear lack of evidence of how these facilitating roles took shape. When students were interviewed, they described how they have had to "explore" contents for their courses individually and in teams, without much scaffolded instruction from their respective teacher educators. The teacher educators did justify the design of tasks where students were asked to "explore things on their own" as a strategy to integrate Constructivism into the learning process. However, there was no evidence of how elements of Constructivism were utilised, except in this use of jargon (for example, "exploring," "facilitator of learning" and "collaboration").

The implication to teacher education is that more research needs to be implemented to understand and document teacher educators' and student teachers' discourse, specifically in the way they frame their understanding about the training of technology for classroom use. The incongruence of discourse between these two key players in the teacher education field would have a direct impact on the success of teacher training.

11.3.3.3 Strong Emphasis on Technology Knowledge (TK)

All of the evidence collected in the study demonstrates that Technology Knowledge (TK) was strongly emphasised in the learning process and student teachers tended to believe that learning Technology Knowledge meant that they were learning about Educational Technology. In other words, they saw Educational Technology as primarily, or even exclusively, a technical subject. This finding is consistent with several studies which were highlighted in previous literature review chapters. When researching on how teachers are trained to use technology, the trend that has emerged has been to focus on the acquisition of technology knowledge. Little has been investigated on how to connect Technology Knowledge, Content Knowledge and Pedagogical Knowledge in a meaningful form. For instance, the Russell study (2003) focused on analysing patterns of technology usage among teachers, as indicators to determine the scope for teacher training's curriculum content. The case studies in this thesis have revealed how strongly TK was emphasised in these Educational Technology courses, signalling a strong bias toward developing technical skills and knowledge as the priority in training teachers about educational technology. Throughout the research, the teacher educators appeared to assume that learning Educational Technology was about learning about Technology Knowledge.

This may prove detrimental to would-be teachers. The lack of emphasis on Content Knowledge and Pedagogical Knowledge in relation to Technology Knowledge may result in these student teachers concentrating only on developing Technology Knowledge. However, as discussed in the previous chapter, focusing on Technology Knowledge may be done because it is a necessary means to an end, rather than a deliberate attempt to isolate Content Knowledge and Pedagogical Knowledge from the instructional delivery of Educational Technology courses at these universities.

11.3.3.4 Presumptions about Student Teachers' Competencies and Prior Knowledge

The teacher educators appeared to depend on students' prior knowledge about learning theories. Consequently, they did not emphasise Pedagogical Knowledge (or its overlapping components in the TPCK framework) in the teaching of their respective Educational Technology courses. Teacher educators also assumed that students would be able to make the necessary "connections" between technology, pedagogy and content knowledge when they progressed through the respective courses. They also assumed that the course projects would provide sufficient learning opportunities for students to integrate TPCK into their work. It is crucial to highlight this evidence as an explanation of why teacher educators emphasise Technology Knowledge at the expense of other knowledge types. As seen in two of the case studies, the teacher educators relied heavily on the student teachers' previous courses which taught them about Learning Theories, Instructional Design, Critical Thinking and so forth. The students were expected to be able to combine and utilise their previous learning knowledge and experiences with those they acquired in the Educational Technology courses.

In contrast, the course projects were expected to reflect an integration of knowledge about teaching and learning, although the emphasis was still placed on how well the students manipulated the use of technology tools in the projects. The direct implication of this practice is the effect on student teachers as they progress in the teacher education programme. The knowledge and experience they leave with when they complete their studies will influence the way they form their beliefs about their roles, decisions about instructional design and delivery, and strategies for developing knowledge for their own students in the classroom. These aspects of teacher training need to be examined and revisited continuously over time to avoid the development of a psychological association made between the use of technology and learning success.

11.3.3.5 Lack of Guidance to Develop TPCK

In the cases observed in this study, the student teachers appeared to be unguided in how to integrate subject matter content and pedagogical theories when learning how to embed technology into a lesson. Students were typically left to their own devices to learn how to blend the three main teacher knowledge components together. Though this may be one of the principles of Constructivism, where students are encouraged to build meaning actively independently and in collaboration with others, there is a lack of scaffolded instruction to help them gauge the students' level of comprehension. This phenomenon may be a backwash effect from the preconception of teacher educators about "educational technology as a focus on technology knowledge only." Indeed, there was scarcely any evidence of scaffolding learning in the Educational

Technology courses. One teacher educator did specifically indicate that he did "scaffold instruction" in his class so his students were able to use technology effectively, but his idea of scaffolding involved making the students search for reading materials independently on key topics that he had pre-selected and presented briefly in class. Students' learning experiences were predominantly built outside the class, usually with little direct guidance from the teacher educator himself. The focus of learning was centred on learning about the technology, not using the technology to learn. This echoes the Williams study (2000), which was reviewed in the Methodology chapter of this thesis, which identified the concept of 'teaching of ICT rather than teaching with ICT.'

11.3.3.6 Cursory Treatment of Constructivist Concepts in Narratives and Tasks

There was recurring evidence of Constructivist jargon in the Educational Technology courses. However, the narratives provided evidence of misconceptions about what Constructivism-in-practice meant. As described in earlier sections of this chapter, jargon like "facilitation" and "self-exploration" was loosely used in the Educational Technology courses observed in this research. It was clear that the teacher educators and student teachers were aware of Constructivist principles that advocate the application of higher order thinking skills, as captured in various interviews in this research. However, there was no evidence of how higher order thinking skills were tangibly addressed in these three courses. When asked to provide evidence of Constructivist use in their lessons, their descriptions consistently echoed those of Behaviourist principles. Though none of the course syllabi or project descriptors mentioned the application of Constructivism specifically, the teacher educators were keen to label their pedagogical approach as being Constructivist-oriented. This was evident in all case studies documented in both pilot and main studies.

This phenomenon related closely to discussions presented in the literature review that highlighted how current rhetoric about ICT applications tended to make connections with elements of Constructivism, almost prescribing the use of Constructivism as a justification to use technology (in general) in educational settings. However, there has not been any phenomenal research on how teacher educators conceptualise and teach using Constructivism in their Educational Technology courses, particularly as part of the training of teachers. This thesis is an attempt to fill that gap in the literature.

11.4 Summary

Findings from the main study have illustrated how TPCK and Constructivism are addressed in the teaching and learning of Educational technology courses at University Z. In sum, it is evident that these two concepts are espoused by the teacher educators, but the artefacts did not provide evidence that these knowledge types were translated into learning actions or events. Student teachers in this study perceived technology as the main learning element to master in their Educational technology courses. Their course projects were designed for them to acquire mastery in using technology tools. Through analysis using the TPCK framework, it is shown that other knowledge types were neglected in the teaching and learning of these Educational Technology courses at University Z.

The next chapter presents the conclusion of the research, which includes a summary based on the two research questions, limitations of the study and future work that may be considered to enhance and expand the scope of this research as a whole.

Chapter 12: Conclusion

12.1 Introduction

This chapter presents conclusions about the findings revealed in this research. It discusses analyses made between the findings of this research and those presented in the literature review chapters in the earlier sections.

This chapter is divided into sections that reflect the key elements of the findings: a broad overview of the motivation for this research; a comprehensive discussion of the key research questions established for the research; limitations of the study; and future work that will enhance and extend the impact of the research to practitioners in the teacher education field. In particular, this will be beneficial for those who are directly involved in the teaching and learning of Educational Technology.

This research has set out to investigate teaching and learning instances that illustrate how Educational Technology courses were taught in Malaysian universities. At the time the research was carried out, there were no earlier studies that examined the nature of teaching and learning of Educational Technology specifically in teacher education. The research is positioned to initiate dialogue and research ideas on how technology has impacted teacher training, particularly in using ICT tools which have been provisioned to many schools throughout Malaysia.

12.2 Research Questions

In this section, both research questions are re-examined to see the congruence between these questions and findings acquired from the entire research.

In order to create an appropriate framework for capturing observations systematically and to aid analysis, a tool was adapted from Mishra and Koehler's model called the Technological Pedagogical Content Knowledge (TPCK) Model. That tool was described in the methodology chapter. These observations and analyses were not obvious at the beginning of the research, so a tool had to be developed that could map this phenomenon. When the adapted TPCK framework was used in the research, data became more manageable in that it could be mapped out graphically onto the framework to reveal patterns and contrasting features between espoused and theories-in-action.

The conceptual framework which was developed for this research is as shown in Figure 12.1 below.

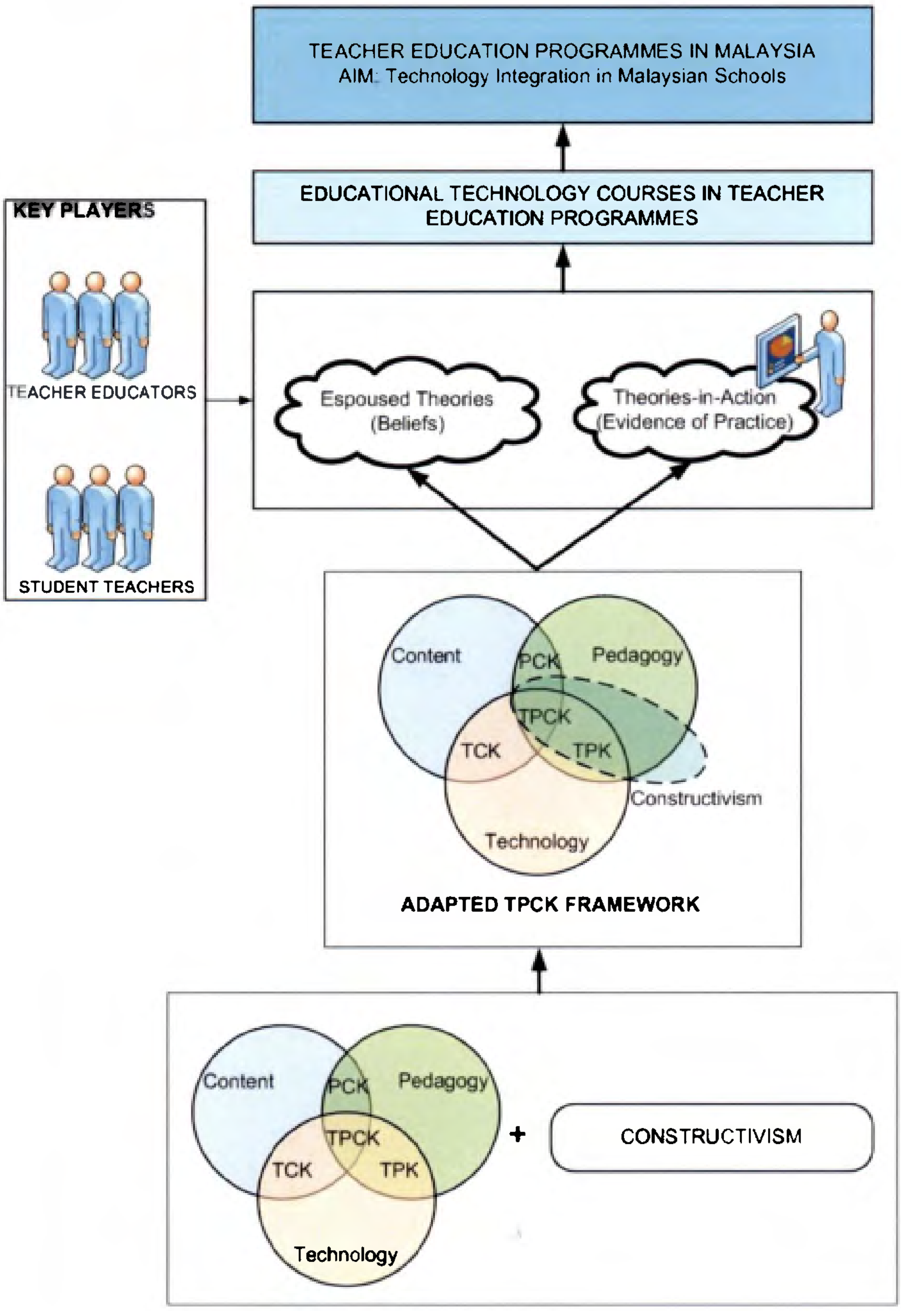

Figure 12.1: The Conceptual Framework

12.2.1 Research Question 1

What are the espoused theories and theories-in-action of teacher educators and student teachers that reflect their teaching and learning of Educational Technology courses?

The most important finding of this research is the evidence of incongruence between the espoused theories and theories-in-action of teacher educators when compared to those of their student teachers. Evidence of incongruence has been documented in the research, through various narratives and classroom artefacts from participants of the study (teacher educators and student teachers). It was clear that the teacher educators' espoused theories did not match their own theories-in-action, in terms of addressing elements of teacher knowledge in the teaching of Educational Technology courses. It was also evident that the students' espoused theories did not match their own theories-in-action. This was reflected in the narratives and class artefacts acquired from all three case studies.

At the start of this research, it was not clear if it was possible to document evidence of espoused theories and theories-in-action. Based on an analysis of current literature on Educational Technology, the trend in research in this field tended to focus on calculating the frequency of usage of ICT tools, rather than looking at how technology is perceived and integrated into instructional delivery. Many studies focused on the perspectives of student teachers who were learning how to use Educational Technology. It became clear that perspectives from the course instructors of Educational Technology courses are often overlooked. This research has been able to gather data from both sides of the teaching and learning dichotomy. The results have revealed compelling evidence of differences between the two groups.

The adapted TPCK framework used in this research has given greater precision than would otherwise have been possible, to map out differences and similarities between the espoused theories and theories-in-action of these two important participant groups in teacher training. Other studies have suggested a technology-practice gap. The adapted TPCK framework has made this issue very clear. It has also made it more accessible to analyse the nature of the congruence.

The case studies revealed that although teacher educators espoused a more grandiose view of their approach to developing teacher knowledge through the teaching of their Educational Technology courses, their students had a different take on their own learning experience. Most significantly, the research has revealed that TPCK, as a knowledge type promoted by the framework, has not been adequately addressed in these Educational Technology courses, despite claims from the teacher educators who were confident that it was. Students were unwittingly being led to believe, through these courses, that Educational Technology equals software training. This is not likely to prompt them to reflect on practice. This finding has provided a useful insight into how teacher knowledge is being developed. It has also shown how teacher educators' perceptions about Educational Technology affect their students' learning experiences, particularly in internalising aspects of technology integration with pedagogical and content knowledge.

12.2.2 Research Question 2

What are their interpretations of Constructivism in their teaching and learning of Educational Technology?

As established in the literature review, Constructivism does have a close relationship with the practice of technology application in the classroom. As seen in the case studies, only a cursory idea about Constructivism was used to justify the use of pedagogy with technology. Teacher educators were quick to justify their approach using jargon that relates to Constructivist principles. However, their students did not demonstrate any tangible evidence of use of Constructivist theory in their narratives or artefacts. In the interviews, it was revealed that students were assumed to have learnt sufficiently about Constructivism in other courses and, on entry into the Educational Technology courses, the students were presumed to be competent in using Constructivism when undertaking class projects.

In both the pilot and the main studies, it was clear that the term Constructivism was used to represent learning principles which closely resembled those of the Behaviourist tradition. Though labels such as 'active learning', 'meaning making' and 'scaffolding instruction' were consistently used by the participants to describe their teaching and learning activities, it was evident from the classroom artefacts collected that the principles of learning which they engaged were those of Behaviourist theory.

12.3 Contributions to Knowledge

One of the primary contributions of this research to the body of knowledge in this field lies in the methodological design of the research. The TPCK model has been used as the basis of its methodological framework. This model has never been used as a methodological tool. To date, TPCK has been primarily used at the conceptual level, to understand the position of technology when used with Content and Pedagogical Knowledge.

An additional contribution of this research is that it introduces two new elements to the original TPCK model – Reflective Learning theory and Constructivism theory. They both contributed to the research methodology in that they allowed the researcher to examine data in a more enriched manner. These two concepts enabled the researcher to consider perceptions and reflections about actions and evidence. They have also opened an opportunity to analyse the use of Constructivist principles within the teaching and learning of Educational Technology courses.

Shulman's PCK model was not used in the research as the main conceptual tool because it does not include the use of technology in instruction. This research was designed to address two new aspects – the use of Technology and Constructivism. The TPCK model was, therefore, adopted for this research, because it reflected specific concerns highlighted in this research.

The use of TPCK as the research framework has also led to new questions about the classifications of data to fit the categories of knowledge portrayed in the original model. For instance, Content Knowledge proved to be a confusing category to use when mapping narratives acquired from teacher educators. The teacher educators had tended to classify Content Knowledge as the Technology Knowledge. In their narratives, they presumed that they were teaching courses on Educational Technology, the Content Knowledge should be about Technology. In the TPCK model, Content Knowledge represents the body of knowledge about a discipline of learning, for instance History or Geography, without any reference to technical (technology) knowledge at all. In the case of Educational Technology courses, the nature of its content combines both education and technology (technical) components. To make Educational Technology work, it typically includes Content Knowledge from other areas of study to exemplify the functionalities of Educational Technology.

In this research, when mapping the teacher educator narratives, it was a challenge to classify data to the knowledge type categories presented in the adapted TPCK framework. The teacher educators consistently used Content Knowledge to refer to Technology Knowledge. When asked for evidence of addressing actual discipline knowledge, the teacher educators argued that the students were already learning about subject-matter knowledge from other courses in the teacher education programme. Their concern in the Educational Technology courses was to focus on developing technology knowledge. This finding brings about an interesting debate about the placement of Content Knowledge in an Educational Technology course. In the categories indicated in the TPCK framework, the categorisation of knowledge types are is clear. However, in cases like the Educational Technology course where its Content Knowledge may also be categorised as Technology Knowledge, the seemingly obvious line to distinguish the two types of knowledge becomes blurred. This is in synchrony with arguments put forward by Hashweh (2005) who debated on the rigid nature of classifying knowledge into different compartments, as was put forward in Shulman's original PCK model (1987).

A significant part of this research was centred on finding out the relationship between the application of technology and use of learning theory (constructivism) in these courses. It was a challenge to include Constructivism in the original TPCK model. It was difficult to justify its position in the framework and it required considerable and lengthy thought, dialogue and reading. However, as the research progressed, it became increasingly clear how important it was to include Constructivism when mapping data of espoused theories and theories-in-action. The new areas which emerged from the inclusion of Constructivism have brought to the fore important issues about how Constructivism impacts on the development of teacher knowledge, particularly for learning about Technology Knowledge. The new areas identified are:

a) Constructivism within TPCK;
b) Constructivism within PCK;
c) Constructivism within TPK;
d) Constructivism within PK; and
e) Constructivism beyond Teacher Knowledge

Constructivism as a learning theory may immediately be classified as belonging exclusively to the Pedagogical Knowledge sector in the TPCK model. However, as seen in this research, the interpretations of using Constructivism did go beyond the boundaries of the model, in that it also represented principles and practices that did not necessarily have to be related directly to the concept of developing Teacher Knowledge.

This research has also demonstrated that it is easy to misinterpret Constructivist principles as illustrated by the frequent use of Constructivist labels in the narratives even though there was no evidence of its practice. The incongruence between what was said and what was put into practice illustrated the common misconstructions of the properties of Constructivist theory among the participants, despite their beliefs that they were integrating Constructivist principles into practice.

12.4 Limitations

There are a few issues that limited the scope of this research.

The first practical challenge affected the methodological design of the research. In the pilot study, permission to record and to collect artefacts was denied by the participants of the pilot study. The researcher also did not have access to class sessions because the pilot study was conducted when the academic semester was over, so that students were no longer available on campus. Class artefacts were also difficult to collect, as teacher educators were reluctant to provide access to their student projects. One of the research sites used E-learning for its delivery of learning. During the interview, the teacher educators claimed that all student materials were available online. However, when asked to show their students' work, nothing was revealed on the online course space. These limitations affected the scope and depth of data that could be reported for the pilot study. It hampered the implementation of the initial methodological approach, which planned to compare and contrast data from espoused theories and theories-in-action for both groups. However, because class sessions were not observed and classroom artefacts were not available, there was limited scope for analysis. As a result, the researcher was only able to make clear mappings from narratives of teacher educators and student teachers from the two universities. Hence, only their espoused theories were analysed in the pilot study. Nonetheless, the findings were adequate to rule out the use of two distinctly different formats for instructional delivery, which were used by these two universities in the pilot study. In the main study, it was decided that conducting research at one university was sufficient to illustrate the treatment of teacher knowledge among the participants.

The second practical challenge was the size of data collected for both pilot and main studies. It would have been ideal to have been able to observe class sessions for longer periods of time during an academic semester, and to be able to schedule more interviews with the teacher educators and their students as they progressed in their respective courses. With a bigger research team and more time, more data would have been collected and analysed to identify the full extent of the gaps identified in this research.

Thirdly, there was a challenge in scheduling and managing the interviews. In the pilot study, one of the teacher educators became hostile and disruptive which meant that very little data was collected from the interview. The researcher was pressed to respond to questions by the interviewee, who believed that his knowledge about the scope of research was superior to that of the researcher, because of his twenty years of experience teaching Educational Technology. There were also instances in the student interviews where the interviewees used the opportunity during the interview to vent their personal frustrations about their teacher education programmes, and about how ICT in Education was implemented in the country, based on their own experiences as school teachers. Scheduling was an issue in both studies: the researcher was promised a time slot for interviews, but participants changed to other times, without giving notice to the researcher. This affected the research schedules for both the pilot and main studies.

The reporting of this study is potentially biased because the study was conducted entirely by a single researcher. However, the single researcher format is a requirement of a doctoral study at the university where the researcher is enrolled. Further work that includes involvement of multiple investigators would have allowed consideration of inter-rater consistency and permitted the cross-checking of results. However, as noted in section 5.7.2.1, work was discussed with the supervisor and was presented at conferences so as to check the credibility of the analysis and interpretations. Under different circumstances, the interpretations of findings from the study could have involved inter-rater validity processes.

The value of the research lies in the format of data acquisition. The single researcher working in this study was able to capture personal accounts from the participants in the interviews. While data capture could not be duplicated if repeated by multiple researchers, theorists such as Kvale (1996) argue that this is unavoidable: the interview is a process of co-constructing understanding ("An interview is literally an *inter view*, an inter change of views", p2). Moreover, this work analyses particular historical incidents of practice – how these courses were described and enacted at a particular point in time. The accounts acquired from the data sources were thus reflective of the participants' opinions, attitudes, motivations and states of mind at the time of interview. The key ideas behind each interview were similar, and have been kept consistent throughout the data collection process; the TPCK framework was helpful in this respect. Each participant input provided a new understanding about how conceptions about teaching and learning of Educational Technology are interpreted in the different institutions of higher learning.

These limitations have reduced the capacity of this research to make across-the-board generalisations about the issues highlighted in the research. However, that was never the intention of this research. Instead, the analyses of these case studies have enabled this research to identify gaps that called for further research into these issues, as the findings have revealed a valuable area of research that has not been examined. The area of how to apply principles of Constructivism in teacher education, particularly in its approach to training teachers to use technology effectively, needs vital attention. This is because it plays a significant role in shaping the mindset, knowledge and skills of future teachers.

A number of other limitations also emerged.

Methodologically, the TPCK framework proved to be a useful tool to map evidence of perceptions and practices in the study. However, it is clear that some of the knowledge types used in the adapted TPCK framework were misinterpreted by the participants. For instance, when referring to Content Knowledge, some teacher educators assumed that because they were teaching a course that is made up of a set of predetermined content, they have sufficiently addressed Content Knowledge in their respective Educational Technology courses. Most of the teacher educators classified Technology Knowledge as Content Knowledge, because they assumed the teaching of technical skills was the core of an Educational Technology course. Similar instances were recorded when asking the teacher educators and their students about Constructivism; it was clear in the interviews that Constructivist terminology was often misinterpreted or understood on a cursory level.

In the initial plan for this research, all mappings on the TPCK framework were to be carried out based on each participant's view of their beliefs and practices in the development of teacher knowledge in their courses. However, during the pilot study, it was clear that there was a need to make a separate mapping for each narrative recorded in the study – one by the participant and the other by the researcher. This was useful for making comparisons between what was claimed by the participant and what actually seemed warranted based on their account of their practice.

In the interviews, it was evident that participants were influenced by their beliefs about their positions and status as teacher educators within a higher education institution. One case in particular, PSTE3 of University Y, interviewed in the pilot study, was determined to control the pace and content of the interview, a sign of imposing his personal belief about his power relations with the researcher. The interview did not materialise as initially planned; instead, it was dictated by the interviewee's strong personality. He persistently asserted that the researcher did not have sufficient knowledge or skills to conduct doctoral level research on the area of study. In another case study, another teacher educator consistently evaded questions about evidence of his practice. His perceptions about how he developed his students' teacher knowledge were positively encouraging in the beginning of the interview, but when asked to provide samples of teaching activities and student projects, he became elusive and referred to colleagues who might answer instead. These instances affected the nature of the interviews conducted, and also the quality of narratives and artefacts collected from the participants. However, the lack of data consequently highlighted the need to acquire tangible data in the main study phase, to match what was claimed and what was actually produced in the classes. The most common position adopted by most of the teacher educators was to protect their personal rank and reputation as experienced academics at a reputable institution of higher learning. The positions simply reflected their desire for conformity with institutional aspirations for academic excellence. There were few instances of candid responses that would have revealed unique experiences in the teaching of Educational Technology courses.

When conducting the study, the adapted TPCK framework has categorised specific types of knowledge to be labelled and clustered in a way that made knowledge about teaching became limited and constrained to a certain degree. The researcher's interview questions might have also contributed to the way the responses were given because a set of terminology was offered (using the adapted TPCK framework) instead of allowing space for the respondents to arrive at an understanding about the TPCK knowledge types deductively. Therefore, it was debatable whether the respondent in the interview genuinely understood the TPCK knowledge classifications.

In analysing the data, a binary approach was used to indicate the presence and absence of evidence for each category of TPCK. The interpretations that led to these classifications were undertaken solely by the researcher. In the course of reporting the results of the study, it was discovered that it was not practical to use the actual TPCK model in its original diagrammatic form to portray the existence of data (as reported in Chapter 11 earlier). It was also found that it was impossible to display the degree of data presence of the kinds of knowledge categorised in the TPCK model. There were several issues that made it impossible to capture degrees of data.

In a few of the case studies, there was narrative evidence that student teachers were learning technology without consciously linking it to pedagogical aspects of teaching. The evidence suggested that the learning of technology was focused on Technology Knowledge only, and not on the other components in the Adapted TPCK framework. However, this could be refuted by an argument that the nature of the Educational Technology courses that the student teachers were enrolled into (up to the time of the interviews) were focusing on learning the technical aspects of Educational Technology, and the course syllabus might not have been created to include pedagogical aspects of integrating technology tools into the teaching process.

Another interesting aspect that was observed in the implementation of the research was the issue of capturing the breadth versus depth of what was taught and learned in each case study observed. The responses from student teacher participants, for instance, were influenced by the content they worked with, or had experience of. Their responses reflected the ideas and theories they encountered, the opportunities they had to develop their understanding by critically engaging with each idea and theory, and their ability to demonstrate or enact their knowledge through the creation of products as outputs from the educational process. For example, an assignment with a definition of constructivism might provide evidence of pedagogic knowledge, but only at what might be described as a shallow level; whereas a lesson plan that was articulated and structured in relation to constructivist ideas might be evidence of pedagogic knowledge that could be described as a deeper illustration of knowledge about the theory. However, while the qualitative description of depth might be credible for a comparison of such obviously different examples as these, that does not mean it can be used as the basis for a credible metric for the quality of ideas. The nature of knowing what they were learning makes capturing the degree of knowledge problematic.

In the study, it has been reported that it was challenging to observe and interview the participants, for both the pilot and main studies. Not only was it difficult to arrange the interview schedule, but the participants insisted on having the interviews in groups rather than individually. Consequently, it was decided that it was risky to assume the data could be quantified or even ranked against some measure of degrees of knowledge. The binary measure was simpler to defend; it provided a straightforward representation of the presence and absence of data. However, the claims made in the thesis, as a whole, have had to be carefully limited because of this. As a result, the study could not offer a more sophisticated account of how well the areas of knowledge were known to the participants. The conclusions, though limited, have nevertheless provided an account of the nature of course design and student experience within these case studies, in the effort to teach and learn Educational Technology in these teacher education programmes. Most importantly, they have identified areas that seem to be neglected, so that these can be attended to in the future.

It is important to note that some of the plans decided for the research did not materialise as planned. In both pilot and main studies, although the participants were told that the interviews were to be carried on a one-to-one basis, they (specifically the student teachers) insisted on being interviewed with their colleagues and classmates. Instead of getting personal accounts from the participants, the responses reflected a more group-influenced feedback; at some stages in the interviews, the responses were discussed and agreed first within the groups, before they were articulated to the interviewer. To most of the respondents, the TPCK framework and all of the elements of teacher knowledge it represented were new to them. It was detected that during the interviews, when the respondents were asked to explain their espoused theories of each knowledge type within the TPCK framework, they did not respond immediately, and instead tended to look at their peers and colleagues for clarification and confirmation before articulating their reply to the researcher. The same pattern of communication was detected when student teachers and teacher educators were interviewed. It was challenging to focus on one person's response during these multiple-participant interviews because the responses given did not reflect personal thoughts, judgments or beliefs; rather, the responses were non-verbally agreed by the other participants in the same interview slot before being conveyed to the researcher.

Another challenge in the data collection process was the effect of the interviews and class observations on the professional identities of the participants. For the teacher educators, their responses seemed to be more guarded and optimistic, and at times they appeared to be protecting their personal interests as members of the higher education institutions where they worked. For the student teachers, their responses were calculated and less candid than originally expected. Some of them cautioned the researcher not to reveal their responses to their respective lecturers, for fear that their responses would affect their grades and personal standing in their classes. These participants' actions and non-actions unexpectedly provided a new, interesting aspect to the value of the thesis. Although the research was originally to document gaps between espoused theories and theories-of-action between these two participant groups, it was clear that the participants were anxious about how their responses in the interviews and class observations would affect their personal sense about what they knew and what they did not know, in the case of this research, about Educational Technology and the different knowledge types in TPCK. Their professional identities as educators and students of Teacher Education were challenged by the researcher, who was perceived as an external entity and a stranger in their community of practice. The personal apprehension was most likely to be the reason why they preferred to be interviewed in groups, rather than alone.

To conclude, the study has illustrated how the TPCK framework proved to be useful as a tool to represent what participants were able to show they knew about the areas of concern defined in the framework. Although it might not efficiently represent the depth, scope, complexity and relational connections that participants may have had about each of the knowledge types and other related knowledge elements, it proves to be a useful tool to initiate narratives about the nature of knowledge and the process of knowing.

12.5 Future Work

With the introduction of the TPCK framework as a plausible methodological tool to map espoused theories and theories–in-action, as featured in this research, future work in the area may consider documenting longitudinal data to understand the impact of beliefs and perceptions about teacher knowledge across the lifespan of a complete teacher training programme, that is, from the moment students register and until the time they graduate, possibly even into practice. It would also be useful to view the training programme in its entirety, to find out how the Educational Technology courses are developed through the years in teacher training programme.

As described earlier, the scope of this research could be developed further to encompass larger groups of participants in order to explore the prevalence of students' experiences within or across cohorts.

To inform practice, findings from research such as this could be used to challenge the way in which personal conceptions about teaching approaches and delivery can influence the design and delivery of instructional strategies, sometimes in ways which appear inconsistent with the experiences of others or with the theories invoked to justify the design. The TPCK framework proved to be a useful methodological tool in this research. It has allowed the identification and analysis of gaps between the narratives of teacher educators and their own students. Such comparisons could enable teacher educators to find a middle ground where they could meet the expectations of their students without jeopardising their own personal principles and beliefs about how they approach the teaching of Educational Technology.

Data from studies like this can also disclose significant and interesting perspectives about how teaching and learning actually take place in a teacher training setting. This is important for policy makers who are responsible for making decisions on national directions about the use of technology, particularly for ICT in education, especially in strategically positioning technology in the national curriculum.

The analyses contribute to curriculum review exercises in teacher training, as they provide valuable feedback about how teacher educators address the age-old issue of translating theory into practice. Feedback from student teachers is also crucial in that it provides insight into their perceptions about the way their experiences in their courses contribute to the development of their professional use of technology. This is a significant departure from frequently used research models that investigate the impact of ICT use when student teachers exit their teacher training programmes. This research is proof that perceptions and beliefs of student teachers while they are learning about ICT applications strongly influence the way they deal with course tasks and projects.

Methodologically the research has broken new ground by comparing two key players in teacher education – the teacher educators and student teachers. Previous studies have rarely covered both groups in a single study and have tended not to compare how the related twin elements – teaching and learning – are enacted and experienced. Although this research has also recorded instances where teacher educators became apprehensive when asked about their perceptions of their own courses, the experience reveals the need to conduct another study that explores the conceptions of teaching of those who are training teachers in each subject discipline. An understanding of how teaching beliefs influence the way teacher training courses are designed and taught needs to be documented and examined.

The study also illuminated the need to understand the differences between knowledge and knowing. These complex and inter-related concepts are crucial in understanding how individuals (in the case of the thesis, student teachers and teacher educators) think and act on what they know within a teacher education context. In future research, the number of investigators should be increased, and the methods to collect data must be diversified. In this study, the main challenge was the single investigator approach used throughout the entire research process, from the conceptualisation of the adapted TPCK framework, to the reporting and synthesis of findings. With multiple investigators, the data would reflect a richer perspective on the educational contexts, participants and artefacts observed in the study. With multiple investigators involved, a series of data collection methods could be deployed. Sets of questionnaires could be designed and disseminated among teacher educators, student teachers, all teaching assistants and faculty staff members, directly and indirectly involved with Teacher Education programmes in other universities (for example, across all Malaysian Universities). Comparisons could be made between public and private universities, to compare conceptions about the teaching and learning of technology in their Teacher Education curriculum. After implementing the survey questionnaires, focus group interviews could be scheduled with selected groups of teacher educators and student teachers. The interviews could focus on pertinent issues that arise from responses in the survey questionnaires. If the focus group interviews are deemed insufficient, individual interviews could be conducted by different interviewers, to capture more personalised narratives from participants. Such accounts could then be analysed, cross-checked and refined by a group of investigators, to avoid bias and prejudice.

The data collection phases for both pilot and main studies were ethically challenging. The participants were briefed at the beginning of each interview that the interviews were to be conducted on one-to-one basis. All participants were told that they have the right to withdraw from the study at any point in time, without prejudice or penalty. In both pilot and main study phases, the student participants were pre-selected by the teacher educators who had been in contact with the researcher prior to the scheduling of both data collection phases. Although it was explained at the initial part of the participant recruitment that participation should be voluntary, the possibility that the participants were handpicked by the teacher educators in an effort to put their best foot forward exists. The selection of student teacher participants was part of the condition for access to the research sites, and was thus beyond the control of the researcher. There were risks that the student teacher participants may have been cautioned to provide a respectable account of their study programme. In a few of the interviews, it was noted that some of the student teacher participants did not want the interviews to be recorded and they wanted a guarantee that their responses were not reported back to their lecturers, whom, they implied, would have an influential bearing on their academic progress in the teacher education programme. The effect of the pre-selected groups of participants might have affected the accuracy of reporting in the thesis, particularly since the responses from the participants were interpreted based on a single investigator's reporting perspective only. There were also risks that the student participants responded to the interview questions because of their personal impressions about the researcher, being a teacher educator from another university in Malaysia, and potentially, a competitor of their own study programme at their universities.

Ethical challenges also emerged from the interviews with teacher educators. At least two of the teacher educators indicated that they wanted to be cited in all journal papers that the researcher would produce based on the research data in the doctoral study, as they have helped the researcher in providing data and access to their students for the pursuit of the doctoral research. They asserted that they had their personal key performance indices to meet each year at their own universities, and their assistance in participating in the research study should not be shelved without proper formal acknowledgement by the researcher through writings of various journal articles after the completion of the doctoral study. It was a challenge for the researcher to decide to continue with the interview with these participants, because access to data was needed to complete the study, but the demand from these key participants made it awkward to pursue the data collection process. To mitigate the issue, the researcher has had to promise to look into possibilities for future collaboration after the study is completed. The strategy seemed to have convinced the participants, as they continued with the interviews without asking further about the scope of collaboration which could be explored between themselves and the researcher.

For all of the interviews, before the sessions began, it was explained to each participant how data from the study would be treated. It was made clear to them that the reporting of data would be limited to only the publication of the thesis and academic journals in related fields of Education. All participant data were to be made anonymous and confidential, and access to all data would be limited to the researcher and her supervisor for the doctoral study only.

For future work, with multiple investigators, there would be a stronger opportunity to select participants from a larger pool. Drawing from a bigger selection of participants, interview data could be triangulated with those from other participant groups, feedback from different sets of questionnaires, and analyses of collected artefacts from various individuals and groups within the Teacher Education programme.

In addition, this research has also shown that it is possible to explore the use and, remarkably, the misuse, of Constructivism in the integration of technology in teacher education. Constructivism is only one of the many theoretical principles on which the construction of Pedagogical Knowledge can be based. Future work could explore the application of other learning theories (to represent Pedagogical Knowledge), and any subject matter content (to investigate the treatment of Content Knowledge), to understand how TPCK works in the training of teachers for their professional use of technology.

In sum, the research has provided a slice of insight into how teacher knowledge was addressed in various teacher education settings. Although findings from the study are highly biased and the probability for replication of the same methodological approach used in the study is slim, this research could be developed further to assist the development of teacher education in Malaysian universities, so the approaches and actions of teacher educators and their students will be congruent with national aspirations to capitalise technology to improve, expand and enrich the quality of Education in Malaysia.

12.6 Conclusion

The purpose of this research was to increase understanding about how teachers are trained to use technology. The problem identified was the lack of systematic tools to analyse interpretations and practices in the development of teacher knowledge from the perspectives of teacher educators and their own student teachers. It has also raised issues about the position of Educational Technology courses. Findings from this research have shown the common perception about content of Educational Technology is the technical knowledge of technology tools. This contradicts the classification of knowledge types as prescribed in the TPCK model. At the same time, it opens alternative ways to view the positioning of content to fit into only one category at a time, as prescribed in the TPCK model, or to be a fluid entity, in that it can fit into any of one, two or more categories, as long as it meets the criteria within the category.

Two research questions were formulated to explore this issue. By developing a new methodology and conducting a series of case studies, it was possible to conclude there is evidence of gaps between espoused theories and theories-in-action of teacher educators when compared to those of their student teachers. Technology Knowledge is heavily emphasised in the Educational Technology courses in participating teacher education programmes. There was a pattern of overlooking the inclusion of Content Knowledge and Pedagogical Knowledge in the training on use of Educational Technology. This research has proved that it is possible to systematically map perceptions and evidence of practice, using the adapted TPCK framework, to initiate discourse about how technology training can be improved for future teachers.

To illustrate one example of a teacher knowledge type, Pedagogical Knowledge, this research also sets out to investigate the interpretations and evidence of practice of Constructivist theory in the same Educational Technology courses. Findings from this research have revealed that there are mismatches in beliefs and practices about Constructivism as a learning theory. This is an important finding because Constructivism has often been associated with the use of ICT in the classroom. In this research, it was clear that constructivist principles were used at a superficial level by both participant groups.

Future work will need to build on this by examining larger groups of students through an entire teacher training programme, within and across cohorts, to provide a holistic perspective of how teachers perceive and practise TPCK through their entire teacher education programme. Other types of learning theories could also be investigated, to initiate dialogue on the depth and balance of learning theories engaged in these Educational Technology courses. Further work could also look into how specific subject matter content, for example History, English or Mathematics, is addressed in the teaching of technology for professional uses of by future teachers.

The adapted TPCK framework introduced in this research is a good starting point to design a visually systematic research tool to classify and categorise patterns and gaps. Consequently, it could initiate further investigation into more complex relationships between content, pedagogy and technology in the training of teachers to use technology in the classroom.

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APPENDIX A Data Collection Schedules

Pilot Study Schedule

Interview	Notes
Teacher Educator at University X (PSTE1)	Interview was conducted in TE1's office; many interruptions by phone calls and work visitors
Teacher Educator at University X (PSTE2)	Interview had to be re-scheduled a few times, due to TE2's busy schedule; interview was done at a conference venue, away from campus
Student Teachers at University X (PSST1-3)	Interview was conducted at students' school, away from campus. Interview had to be rescheduled twice.
Teacher Educator at University Y (PSTE3)	Interview was conducted in TE3's office
Student Teachers at University Y (PSST4-5)	Interview was done in a quiet room on campus

Main Study Schedule

Interview/Class observation	Notes
Observation at MSTE3's class	Observation was done during lab session in Multimedia Lab on campus
Teacher Educator at University Z (MSTE1)	Interview was conducted in TE1's office

Observation in MSTE1's class	Observation was done in a computer lab on campus
Teacher Educator at University Z (MSTE2)	Interview had to be rescheduled a few times due to TE2's personal constraints
Observation in MSTE2's class	Observation was done in a computer lab on campus
Student Teachers at University Z (MSTE2's students) (MSST3-5)	Interview was done during TE2's class session, with consent from TE2. Interview had to be rescheduled a few times.
Student Teachers at University Z (MSTE1's students) (MSST1-2)	Interview was done in a quiet room on campus. Interview had to be rescheduled a few times.

APPENDIX B Information Sheets for Teacher Educators

Note: This document was sent to all teacher educators who participated in the study, prior to setting up the data collection schedule with the participants. A cover letter/email was attached with the document to explain the contention of the research.

Introduction

You are being asked to volunteer to participate in a project conducted through the Institute of Education, University of London. The University requires that you give your signed agreement to participate in this project.

The researcher will explain to you, in detail, the purpose of the project, the procedures to be used, and the potential benefits and possible risks of participation. You may ask him/her any questions you have to help you understand the project. A basic explanation of the project is written below. Please read this explanation and discuss with the researcher any questions you may have.

If you decide to participate in the project, please sign this form in the presence of the person who explained it to you. You will be given a copy of this form to keep.

Research Topic: Building Teacher Knowledge through In-service Training to develop professional uses of Technology

Purpose of study

This study aims to explore approaches and strategies used in the teaching and learning of Educational Technology courses, which are offered in teacher education programmes at Malaysian universities. This study is a compulsory requirement to complete a doctoral thesis in the area of interest. This study is an attempt to understand issues surrounding the use of technology in teacher education programmes in Malaysia, the findings of the study will be used to validate the thesis formulated for this research.

Procedures

To start, this study requires participation from universities in Malaysia which offer teacher education programmes that include educational technology as part of their teacher preparation module. The criteria for selection for participants in the study are listed below:

Teacher educators/lecturers:

Have been involved in the teaching of one of the courses offered through the educational technology module for teacher education

Familiar with the institutional approach used

Preferably have been involved in the design of educational module

Currently teaching teacher trainees, and are also involved in the assessment procedures used in the educational technology module

Student teachers (will be selected by you (the lecturer), to fairly represent the high and average achievers in your educational technology classes):

- Are either In-service or pre-service teacher
- One male student and one female student to represent each gender (minimum 2 students for the interview)
- Enrolled in one of the study programmes offered by one of the three selected universities
- Have completed at least one educational technology course in their respective teacher education programmes at the university
- Have completed course assignments or projects which used constructivist principles in the educational technology module

This study will use four main procedures for data collection: document analysis of existing educational technology module's curriculum, 45-60 minute interviews of teacher educators and student teachers from each university, and analysis of classroom artefacts (projects, assignments or tasks which incorporate the use of Constructivism in the design and development of each artefact), and classroom observations.

Curriculum analysis

Documents which describe the educational technology module that is offered at each university will be collected and analysed, as a strategy to understand the context of teaching and learning of Educational Technology for teacher preparation. If clarification needs to be made, questions would be raised during interviews with the teacher educators involved in this pilot study.

Interviews

Every participant of the pilot study will be interviewed individually, for approximately 45-60 minutes per session. The interview will cover issues regarding the issues faced by teacher educators and their student teachers in developing their professional uses of Educational Technology. The interview uses a semi-structured approach, to capture a more generic outlook about the development of teacher knowledge within teacher education programmes in Malaysian universities. The interview will also include questions regarding the educational technology curriculum and the classroom artefacts used in the existing Educational Technology courses.

Classroom artefacts

Projects, assignments, and assessment documents

The researcher would like to collect copies class projects, assignments and assessment documents which are identified by the teacher educators, which will be used as artefacts for the study. These materials will be partially used in the interview sessions with the participants of the study.

Online discussion materials

For educational technology courses which use online discussion as a tool to interact, the researcher is interested to collect a selection of transcripts of online discussions, and these will be used as samples of how educational technology is dealt with in each teacher education programme investigated in this research.

Classroom observations

With permission from the teacher educators, one of the educational technology classes will be observed for the purpose of this research. The classroom observation will focus on the use of constructivist principles in the delivery of content, particularly in a lecture or tutorial format used by the teacher educators.

Possible benefits

The outcome of this study will define and describe a perspective about the existing practices in teacher education, in terms of pedagogical considerations that integrate elements of constructivist theory, as used by current teacher educators and student teachers. To the participants, this is an advantage to reflect on existing understanding and practices that occur in their own learning environments at Malaysian universities. Discourse in this area is hoped to initiate wider opportunities for further research into the professional uses of educational technology, in hopes to enhance the quality of teaching and learning using technology, at existing teacher education programmes.

Compensation

As a participant of this pilot study, you will receive a small gratuity as a token of appreciation and compensation for your time and effort to be involved in the research. However, if you decide to withdraw from the study prior to its completion, the gratuity will be forfeited. The gratuity will be given to you at the end of the data collection process.

Confidentiality

The information collected in this pilot study will be kept confidential. Data will be stored securely and will be made available only to the researcher and her supervisor, Dr. Martin Oliver, unless participants specifically give permission in writing to do otherwise. No reference will be made in oral or written reports which could link participants to the study.

Contact information

If you have questions at any time about the study or the procedures, you may contact the researcher, Fitri Suraya Mohamad, at The School of Mathematics, Science and Technology, Institute of Education, University of London, 20 Bedford Way, London, and at +447765476980. If you have questions about your rights as a participant, contact The Doctoral School office at the Institute of Education, University of London.

Consent

I voluntarily agree to participate in the pilot study on "Pedagogical Effectiveness of Constructivism in Educational Technology modules taught in Teacher Education Programmes in Malaysian Universities. I understand that this pilot study is being conducted by Fitri Suraya Mohamad, a doctoral student at Institute of Education, University of London, to survey aspects of teaching and learning of existing Educational Technology modules in Teacher Education in Malaysia, and findings of this pilot study will be used as the foundation of her doctoral dissertation.

I understand that the research methods which may involve me are:

1. Class observations: Observations of my teaching/learning processes in one of my Educational Technology courses.
2. Interview: my participation in a 30-60 minute interview.
3. Classroom artefacts: The materials used in my educational technology courses that apply elements of Constructivism in their instructional design process.
4. The Educational Technology module's curriculum, and the syllabus of courses I teach at the university

I grant permission for the interview and class observation to be tape recorded and transcribed, and to be used only by Fitri Suraya Mohamad for analysis of interview data. I grant permission for the evaluation data generated from the above methods to be published in her thesis and any future publication(s) in relevant fields.

I understand that any identifiable information in regard to my name will not be listed in the dissertation or any future publication(s).

Research Participant

Date

APPENDIX C Information Sheet for Student Teachers

Note: This document was sent to all teacher educators who participated in the study, prior to setting up the data collection schedule with the participants.

Information Sheet for Participants

Introduction

This study aims to explore approaches and strategies used in the teaching and learning of Educational Technology courses, which are offered in teacher education programmes at Malaysian universities. This study is a compulsory requirement to complete a doctoral thesis in the area of interest. This study is an attempt to understand issues surrounding the use of technology in teacher education programmes in Malaysia, the findings of the study will be used to validate the thesis formulated for this research.

Purpose of study

The research is designed as a user-based study in that these interviews will play an important role in formulating an understanding of issues in the teaching-learning of educational technology within teacher education programmes at Malaysian universities. The doctoral thesis is designed to contribute to the understanding of professional uses of technology at teacher training level.

Researcher and Supervisor

Researcher:: Fitri Suraya Mohamad, School of Mathematics, Science and Technology, Institute of Education, University of London, London, UK. Email: f.mohamad@ioe.ac.uk.

Supervisor:: Dr. Martin Oliver, London Knowledge Lab, 23-29 Emerald St, London, UK. Email: m.oliver@ioe.ac.uk

Research Procedures

To obtain information to support this user-based study, the researcher wishes to interview you for about 45 to 60 minutes. In the interview, you will be asked about your experience in teaching/learning educational technology in the teacher education programme at your university.

Criteria of Selection

You have been considered for participation in this project because your lecturer has recommended that you would be available for interview.

How the data will be handled in the study

Information obtained from you through the interview session will be used to inform the research work of the project. Personal data collected from this study including your name and contact details will be kept confidential. Data will be stored securely, and will only made available to the research team of the project, unless participants specifically provide permission in writing to do otherwise. No reference will be made in oral or written form that could link to any participant of the study.

Participation

Your participation in this study is voluntary; you may decline to participate without penalty. If you decide to participate, you may withdraw from the study at anytime without penalty and without loss of benefits to which you are otherwise entitled. If you withdraw from the study before data collection is completed your data will be returned to you or destroyed.

Compensation

As a participant of this pilot study, you will receive a small gratuity as a token of appreciation and compensation for your time and effort to be involved in the research. However, if you decide to withdraw from the study prior to its completion, the gratuity will be forfeited. The gratuity will be given to you at the end of the data collection process.

Once you have read and understood the information enclosed here, please complete the form on the next page.

Consent form

Please read the information sheet attached before you complete this form.

Section 1: Personal details

Please complete these items. PRINT CLEARLY.

1. Name ______________________
2. Age ______________________
3. University ______________________

Section 2: Consent

Please delete any statement you do not wish to agree with.

1 My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time.

2 I understand I have the right to withdraw from the study at any time and to decline to answer any particular questions.

3 I agree to provide information to the researcher(s) on the understanding that my name will not be used without my permission (The information will be used only for this research and publications arising from this research project.)

4 I agree to the interview being taped.

5 I agree to the interview being video taped.

6 I confirm that I am over 18 years of age.

7 I understand that I have the right to ask for the audio/video tape to be turned off at any time during the interview.

I have read the Information Sheet and have had the details of the study explained to me. My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I agree to participate in this study under the conditions set out in the Information Sheet.

Signed…………………….. Date………………………

APPENDIX D Interview Questions

INTERVIEWER INTRODUCTION

Purpose of study.

We are recording the conversation which will be transcribed and anonymised. No personal data will be held with the transcription. You are free to view a copy of the transcription at any time. The transcription will not be available publicly except for extracted quotes to illustrate points that emerge from the study. Are you comfortable with this?

INTRODUCTION OF INTERVIEWEE

Could you briefly introduce yourself?

Student Teachers: Can you describe how you decided to enrol into this teacher education programme at this university?

Teacher Educators: Can you describe how you came about teaching this programme at the university?

Can you describe your academic qualifications before you entered this programme?

ICT SKILLS/EXPERIENCE

Can you describe your current ICT skills, from a range between 1 to 10, 1 being novice user, and 10 being expert user?

Are you confident with the knowledge you have now of technology that you are able to teach using ICT?

How would you describe your learning styles? (What approaches do you use to manage your learning in this teacher education programme?)

ESPOUSED THEORIES ABT EDUCATIONAL TECHNOLOGY

How would you describe your educational technology courses here at the university? (Use syllabus list to guide)

Student Teachers: How would you describe the way educational technology is presented to you in this programme?

Teacher Educators: Can you describe how educational technology (in general) is presented to students in this programme?

BUILDING TEACHER KNOWLEDGE ABOUT EDUCATIONAL TECHNOLOGY

What does educational technology mean to you?

How do you think it can be used in the classroom?

Can you describe the tools you have been introduced to in this programme?

Can you describe how do you learn about using technology in a lesson?

Do you foresee any problems using technology in the classroom?

<Explain the TPCK framework here, and the general aim of this research in relation to the use of TPCK framework in the research.>

CONTENT KNOWLEDGE

Can you explain what you would consider as Content Knowledge in your course?

Can you describe where you think Content Knowledge was addressed in your course?

PEDAGOGICAL KNOWLEDGE

Can you explain what you would consider as Pedagogical Knowledge in your course?

Can you describe where you think Pedagogical Knowledge was addressed in your course?

TECHNOLOGICAL KNOWLEDGE

Can you explain what you would consider as Technological Knowledge in your course?

Can you describe where you think Technological Knowledge was addressed in your course?

PEDAGOGICAL CONTENT KNOWLEDGE

Can you explain what you would consider as Pedagogical Content Knowledge in your course?

Can you describe where you think Pedagogical Content Knowledge was addressed in your course?

TECHNOLOGICAL CONTENT KNOWLEDGE

Can you explain what you would consider as Technological Content Knowledge in your course?

Can you describe where you think Technological Content Knowledge was addressed in your course?

TECHNOLOGICAL PEDAGOGICAL KNOWLEDGE

Can you explain what you would consider as Technological Pedagogical Knowledge in your course?

Can you describe where you think Technological Pedagogical Knowledge was addressed in your course?

TECHNOLOGICAL PEDAGOGICAL CONTENT KNOWLEDGE

Can you explain what you would consider as TPCK in your course?

Can you describe where you think TPCK was addressed in your course?

CONSTRUCTIVISM

Can you explain what you understand by Constructivism in the context of your course?

Can you describe how Constructivism was used (taught and learnt) in your course?

CONSTRUCTIVISM AND PEDAGOGICAL KNOWLEDGE

Can you explain what you would consider as Constructivism within Pedagogical Knowledge in your course?

Can you describe where you think Constructivism within Pedagogical Knowledge was addressed in your course?

CONSTRUCTIVISM AND TECHNOLOGICAL KNOWLEDGE

Can you explain what you would consider as Constructivism within Technological Knowledge in your course?

Can you describe where you think Constructivism within Technological Knowledge was addressed in your course?

CONSTRUCTIVISM AND PEDAGOGICAL CONTENT KNOWLEDGE

Can you explain what you would consider as Constructivism within Pedagogical Content Knowledge in your course?

Can you describe where you think Constructivism within Pedagogical Content Knowledge was addressed in your course?

CONSTRUCTIVISM AND TPCK

Can you explain what you would consider as Constructivism within TPCK in your course?

Can you describe where you think Constructivism within TPCK was addressed in your course?

Is there anything else you would like to add to your comments?

This is the end of the interview. Thank you very much.

APPENDIX E Interview Transcript of MSTE1

Main Study: Transcript of Interview with Teacher Educator at University Z (MSTE1)

Source	*Data*
Q	We start with an introduction about yourself dulu, your academic background a little bit, and how you came about teaching this Educational Technology courses di University Z.
A	Saya MSTE1, my background is from Islamic Education. Ijazah pertama saya ialah Sarjana Muda Pendidikan Islam. Kemudian saya mengajar di Sabah, for two years, kemudian selepas itu, saya masuk ke SLAB program. Masuk University Z, dan pergi buat Masters di University of Warwick, UK. So masa di University of Warwick tu, dia ada levels of majoring lah. So Sociology and Education. Sociology of Management actually, and Education. Technology, sorry, Technology of Education. So masa itulah saya bermulanya saya…(laughs)..
Q	…berjinak-jinak..
A	…berjinak-jinak dalam bidang teknologi. Masa tu, kita nak tengok Berita Harian, Utusan, tak de lagi masa tu. Masa tu, black and white, kita gunakan Unix system, read through, and then tengok Bernama. Itu je yang kita dapat. (laughs).
Q	That was many years ago, actually..
A	Yes, '94..
Q	Yeah, yeah '94..
A	So daripada situ lah. So bila balik ke sini, saya memang go for Foundation dulu, Foundation, Prinsip tu semua, Sociology dan Policy… ketika tu, ada perubahan structure kepada jabatan-jabatan..ketika itu saya dah dipindahkan di atas minat, ke Jabatan Kurikulum dan Teknologi Pengajaran..

Q	So you got moved to the Jabatan Kurikulum dan Teknologi Pengajaran..
A	Before ni, it was Asas-Asas Pendidikan..Educational punya Foundation, Jabatan..
Q	Hmm..
A	So..dan… saya start.. salah satu kursus, ada satu kursus yang initiate by me, they call it is Teknologi Pendidikan Islam.. Yang ini kursus dibina untuk keperluan pelajar-pelajar pendidikan Islam, because di Fakulti Pendidikan, kita serving kepada Akademi Pengajian Islam. Di Akademi Pengajian Islam, dia orang akan ambil kursus dari Usuludin, syariah, amd then, Pengajian Islam dan Pendidikan. So pada masa itu, saya lihat ada keperluan pada guru-guru Pendidikan Islam, ustaz ustazah nanti, untuk mereka mengajar, ada technology background. Jadi saya create that time as an elective course, tapi selepas tahun 2002, dah jadi compulsory dah, bila mereka buat penstrukturan semula tentang ijazah tu. So itu kira my child lah..
Q	Right.. When did it start? Do you remember? What year was that?
A	Yang mana?
Q	You kata, Teknologi Pendidikan..
A	Teknologi tu '96, '97, masa I mula-mula balik dulu..
Q	So kita start about the same time, la kan?
A	Yeah..(laughs)
Q	OK..go ahead..
A	OK..itulah yang special, dan sampai sekarang, saya masih mengajar that kursus. Dan every year, saya tak dapat nak beri sepenuhnya kerana ramai..dan kelas tu terhad. Tapi sekarang ni, alhamdulillah, the last batch, masa dia orang punya interview, Teknologi ni jadi macam advantage kepada dia orang..Dan sekarang mereka diserap jadi pensyarah di politek..
Q	Oh yeah? That's good! Graduates yang dah habis, have you managed to see them at all?

A	Online..through email.
Q	And have you seen the result of this?
A	Ahh yeah, itu yang dia orang bagi tahu pada saya, "Ustaz ni, kita orang dah di politek, dah jadi pensyarah." "Ohh.. macamana.. selalu posting pergi sekolah…ni kenapa ni?" "Tu lah, ustaz lah, ustaz"..(laughs)
Q	Di sekolah, is it useful? Ada bahan-bahan pengajaran untuk Agama, yang guna CDs and internet?
A	Guna CDs but tak banyak digunakan…dan kebanyakan guru-guru, nak kata phobia, dalam penggunaan teknologi ni..Jadi generasi yang keluar dari Pendidikan di Akademi Islam…maksudnya, dia boleh…menggunakan.. mesra teknologi… Setakat ni, yang kita pergi practical, student practical…dan masa kita buat penyeliaan tu, sambil kita menyelia, kita tengok student lama…dapat pujian lah, daripada Pengetua, staf..”Bagus ustazah ni, sekarang ustazah ni pegang kunci makmal".. "Ohh ok, tak pe..
Q	Ohh so jadi ICT coordinator kat sana lah?
A	Yes.. memang ada… jadi they make full use, macam pengajaran, they use LCD apa semua…rather than watch saja..so student pun interested lah, and dia orang pun update dia orang punya knowledge… and kalau student cakap pasal blog ni, blog ni…so isu yang dalam masyarakat dan pelajar, dah lain dah.. dapat diajar, maksudnya bukan lagi terpinggir…dalam golongan ustaz ustazah ni…Maksudnya, apa yang dicakap disitu, kita bercakap dalam bahasa yang sama…Selalunya ustaz ustazah tahu apa.. tak tahu apa..
Q	That was the old perception, isn't it?
A	Yes, itu lah. Impact of the technology to the..
Q	One of the student that I met in usm lah, he was an ustaz in school. Dia pun ada cakap, boring terpaksa ajar bahasa arab. Dululah, mula-mula sebelum ada teknologi. Budak-budak pun tak interested sagat pun dia kata. Sekarang, dia tahu nak pakai so dia ni lah, budak-budak pun semakin lebih interested nak masuk kan. Pastu dia boleh incorporate dengan subjek lain, jadi apa

	yang dia ajar dalam bahasa arab tu punya classes, dia boleh masukk bahan-bahan daripada sains, matematik, jadi dia kata, budak2 budak pun jadi interested. Itulah, I think they have one of the thinkgs that you have mention tadi..
A	Student, kalau kita direct macam kalau kita bincang about salah satu topic kat sekolah ; ajaran sesat. So kalau kita refer tu apa ni, dalam hutan lah apa semua. Sekarang, ajaran sesat boleh review kat air hangat. And then, you join the group, its already ajaran sesat.
Q	That's true.
A	Ada perspektif yang kita ubah dengan adanya ajaran teknologi. Student yang guan computer, they are capable lah.. they are capable..
Q	Right..
A	Penguasaan dia mengenai pelajar dan mengajar pun meningkat. Rather then dia rasa macam ustaz, ustazah macam sebelah. Ni boleh bincang plak, semalam saya tengok dari web ni… okay, saya tengok. Kita bincang balik.
Q	How do you describe your skills as user in ICT? Do you kalau macam boleh rate from 1 to 10. 1,2,3. 1 being poor and 10 being excellent.
A	9 lah?
Q	9 . (laughs) how do you get to number 9?
A	9. masih kata relative lagi sebab dunia teknologi masih meningkat makin advanced kan, so for current la, for current, it is 9. kita takk boleh claim the new one kan?
Q	Ada orang cakap 11 (laughs) ada..
A	Ada?
Q	How confident are you dalam pengajaran? I think this is a nil ah, given question. Pengajaran menggunakan teknologi. Now macam, ada juga lecturers macam, although dia mengajar pasal teknologi, tapi dia tak menggunakan teknologi dalam classroom. What do you think about your

	own?
A	It is an effective tool, sebab teknologi bukan saja sebagai alat tetapi dia merupakan satu framework. Maksudnye kita menggunakan teknologi bukan saja pada alat itu saja tetapi kita merancang dari secara keseluruhan. Itu yang kita kata teknologi tu. Bukan kita kata 'oh, ini alat untuk guna. Kita ada smartbook, kita guna smartbook'. Maksudnya, kita nak merancang menggunakan smartbook, kita mesti ada kita punya foundation, bagaimana kita nak menggunakan secara efektif. Bukan kita kata mainly a tool. Itu yang kita gunakan tu.
Q	Right, apa macam, dalam teori yang saya guna untuk describe kan penggunaan dan persepsi teknologi, dia kata, dia macam nit au, dia kata, urm.. kita ada content, content is about you know.. subjek matter macam movie mengajar agama, ajar bahasa arab, itu that is content lah. And then there is another paralogy. Paralogy ialah pengajaraan untuk mengajar kan.. ada satu taste di sini yang kita boleh describe apa nama kalau kita content tapi kita tau teknologi tetapi tak semestinya kita tau mendirikan kedua-duanya sekali. Sebab itu kita perlu mengajar, apa nama, cikgu, macam mana nak mengajar properly. Pastu, this is the thing that we are macam, covering in educational , oh sorry, in teacher education. Yang mana kita, intergrasikan setengah pengajaran dan juga content supaya dia boleh berfungsi di this area la. Sekarang, dengan teknologi, it becomes another, you know.. more aspek serius . So, this is technology yeah? So, bila ada technology, this area becomes more complicated. Sebab bukan pasal kita cover tentang content dan paralogy, sekarang kita kena mengajar dia macam mana nak intergrate dengan teknologi sekali supaya pengajaran dia lebih efektif. Yeah. So ini adalah cara yang saya akan gunakan latar, remote ni untuk explain. Macam mana kita perceive penggunaan dan intergrasi teknologi dalam pengajaran. So, itulah teori yang saya akan test basically. So, apa nama, what do you think in perception enn. Hasyimi sendirilah yang kita, yang yourself lah, how much you think you cover in your class in terms of penggunaan, dalam isu.. roughly tell me.

A	Saya actually, I'm covering la. Saya menggunakan sepenuhnya actually. Sebab content yeah, it exist kemudian teknologi. Cuma dalam paralogy dalam teknologi kalau kita merujuk kepada instructional design, so, alternatively it covers. So, the content must be there lah. How we approach the content and how we modify the content using instructional design.
Q	What about this area?
A	Okay,coming back to here. Bila di sini, kita kena tengok content. Each content yang kita boleh guna appropriate technology. So, it's still here, even here pun. Okay, which technology it means kata you nak buat online discussion. Okay, contohlah, in my case, online discussion yang previous one. I sebelum ni memang guna yahoo groups.Tak ada masalah. Each of the course semua ada own, apa, yahoo group. Maksudnye, kita bincang-bincang. Tapi, last semester yang berlaku pada my group, adalah spamming, spamming, kemudian dia kick auto-generate. I dah hantar kepada yahoo, yahoo apa ni, the system pun bagitau balik, dia kata dia didn't do their best. Lepas tu, that is, apa,apa ni, bad experience to me lah and then, yang keluar tu macam-macam. Maksudnyer, bila kita buka-buka jer, dia keluar yang nasty punyer ni, bad islam, apelah tuhan. Yang itu I tak sanggup pulak, I dah berdepan dengan student-student from Islamic education kan? Pastu, bila kita tengok balik, dia datang daripada satu computer. Daripada satu computer, tapi lepas tu dia auto-generate dalam system yahoo tu.
Q	I see..
A	Yang tu yang bad tu. And then, macam....
Q	Macam?
A	Hello. Assalamualaikum. Macam my initiative untuk berlaku technology. Memang I treat macam website ni dah lama dah untuk pengajaran, untuk membantu pelajar, untuk , have that access kemudian, apa-apa saja bahan-bahan yang I baru jumpa I masuk dalam notes there. Dalam notes diorang akan dapatlah, Cuma depends on their punye initiative untuk go futherlah. And, I'm hoping, ni kena centre skit lah. I'm hoping the management will have the lms for the university. Okay, dulu adalah, I tapi tengok system, I

	dah tengok tapi I kata takleh go. And drop it. Masa tu akta still here.
Q	I see..What system was that? Do you remember?
A	Yang diorang buat. Urm.. Ada system yang diorang tengah on kan?
Q	Right,right..
A	Okay,, so tengok, I kata, I dah nampak, I kata tak boleh. Sebab macam sekarang ni pun I tengah buat consultant dekat syarikat, syarikat swasta ni. Based from my experience, so I kata tak boleh. Itu yang I buat jugak. Kemudian, I'm searching for the open source.
Q	I see.. Kena reason why are you looking for open source? Apologies..
A	Untuk memudahkan kita punya bahan itu di, di indekskan. Bila kita guna apa tu com..com..
A	So, all the tagging, memudahkan kitalah. So, all in the system, all in the database. That we can retrieve easily lah. Kalau maca sekarang, normal, normal web pages, you put put there, you cannot, taking all the things, you cannot track dia punya program kan?
Q	What about propriety.. urm.. apa nama, learning platform macam webcity ke?
A	Urm.. Okay.. I tengok, masih ada kekurangan. Masih ada kekurangan.. Sebab tu I go for open source. Sebab kita boleh modify accordingly. Ada benda yang kita nak dan ada benda yang kita tak nak kan? Macam yang tengok kat e-tutor tu. E-tutor okay. Apa kata, features dia banyak, kemudian, kita boleh modify lah. Kita tak boleh menggunakan satu system yang strictly you have to follow all the things right?.
Q	Dia basically you want to customize it to..
A	Yes, Customize according to your needs lah.
Q	Do you have a good technical support team here?

A	Hurm, Kita kena buat sendiri. Itu je.
Q	Yeah, we have the same problems at any most gak..
A	Semua kena buat sendiri?
Q	Yeah,yeah.
A	People duk kata, eh, where are you? Sebab kalau tanya kawan-kawan yang lain, eh, jarang nampak. Yelah, kita berdepan dengan computer. I sama duduk dalam bilik atau I duduk kat lab. Ataupun macam kat biology ada friend, so you get together. Kita duduk mengadap computer punya lama. Tu duk kata, dia ni tak nampak muka ni,tu kata, takpelah, duk duduk depan computer ja. Sampai sekarang pun dah rasa letih dengan computer. At one time memang kena pergi crash dulu. Rilek..
Q	(laughs) I know, I know exactly what you mean. Urm, so kalau macam, urm.. in these terms kan, macam how do you interpret kata, antara content dan technology dalam your class. You isolate it or do you think you are interpreting..?
A	Interpreting.
Q	Owh, okay. Kalau..
A	In our class. sorry ye? Macam pengajaran guna any technology you can, available, and the student, we are encourage to use technology. Okay, even walaupun diorang dah belajar in account, belajar searching dan apa semua,I ajar balik macam mana you get the specific you want you search, kata, in a short time. Sebab kadang diorang tak dapat nak go for it lah.. Walaupun diorang belajar, Tapi belajar as a teori, tapi bila, sampai pada pronunciation, I kena ajar macam mana.
Q	Oh, I see..
A	Even benda-benda, yang kadang-kadang I assume this one is basic, learn in application, in computer application. Tapi, rupe-rupenya diorang tak tahu..
Q	Oh, I see..

A	Macam contoh okay, kata sekarang ni as a keperluan, you kena tau macam mana nak compress a file and uncompress it. Kemudian, using PDF, okay. Benda tu memang basic lah. Ha, tapi benda tu tak tau.So, lacking lah. Masa tu lah yang I tengok, I approach content apa yang diorang belajar, at the same time what ever level of technology I upgrade. Maksudnya, Integration sama, kemudian I go to the technology level to upgrade they, so they can accomplish their task.
Q	Do you access them at the beginning? See, at which level are they at, in terms of how do you do that?
A	By, going to one side ant then they upgrade themselves. So, they give me the points.
Q	So, it's like self-evaluation. So, do you do it again at the end of the slot or macam mana?
A	Yang itu selalu terlepas. Tapi memang dalam rancangan la..
Q	Right, kalau macam kita ambik one of the tugasan that you have done here, can you describe to me, kalau macam kita boleh, kalau kita gi map coverage in one of your tugasan in this rainbook, how would you explain that?
A	Okay, apakah serangkai computer? Kemudian peralatan perangkai computer. So, macam ape yang diorang buat sekarang, ialah I give their, their past assignment. So their knowledge is zero. Okay, so they explore. Based on the assignment, they get their condition la. And then dia explore lah. Bila dia explore, kita bagi time frame and they explore. And then they come back to their groups, and they matching it guna mainan meja. And matching it guna ape yang diorang cari and discuss it. I make sure they are meeting their conceptual of the topic, kemudian, Yang tu yang I kata, this is the first version. And then. Kita ada speakers. Lepas speakers ni dia akan tunjukkan whatever peralatan macam mana, I just inform there la. Nanti kita tengok la apa yang dia perform. Ada benda-benda yang lacking. Yang itu I support balik after the session, after the next session. Apa yang presenter ni bagi, benda yang kita buat, version yang

	kedua, I akan tengok version yang kedua Still lacking, I'll put out the things. I tak nak terus bagi ni..
Q	Basically you are letting them to learn from their mistakes la?
A	Yeah
Q	Right, are you putting out the lacking date ataupun, okay.
A	Yeah, Maksudnya, I assume there are three version now. The first one, the second after the presenter, kemudian, they putting their presentation, ada lacking go where, small talk.
Q	Okay, I see.. Apa nama kalau..
A	Internet as a tool yang banyak digunakan la. Untuk buat searching, untuk buat get the ideas, get the terms-terms yang digunakan misalnya untuk peralatan, words server, domain.
Q	But macam mana, because this course the nature of this course is very technical I think, how do you.. is there any lessons planning at all in this course ataupun or you know, lesson design dalam this course it self?
A	Lesson design..? I got my plan book lah. That is lesson plan.
Q	No, no. Untuk student. Untuk project student. Ada diorang kena buat lesson plan tak?
A	Allah, sebab kalau macam ni diorang kena keep in Microsoftword and Powerpoint. and the second one. They are using blog. Okay, so whatever, they have their own plan book.
Q	Yeah,I understand that. But the project it self bukan , tak ada macam bagi latihan untuk membuat lesson plan menggunakan blog katakanlah, untuk menggunakan wap katakanlah.It is not..
A	It is not access..
Q	Yeah, yang itu..
A	Yang itu dah diorang pada kelas-kelas yang lain. Application jer..

Q	Right, right. Because..
A	Sebab macam dalam reka bentuk, they have to make their own,okay,for each project that is for reka bentuk and for multimedia. Okay, they should, okay,they mesti ada model apa yang diorang akan gunakan dan apa semua. This one is more on practical.
Q	I see.. Do you teach any of these multimedia courses?
A	Oh, tidak..
Q	I see.. Urm, What about, what is your opinion about penggunaan teori Constructivism dalam pendidikan technologi?
A	Very good.
Q	Yeah?
A	Yeah, Because student akan learn about, okay, beyond yang kita expect. Tapi kita kena track. Sebab dalam dunia intenet ni macam-macam yang diorang akan jumpa. Kadang-kadang tersesat kat takat situ je.. Kita kena track balik apa yang kita nak. Kita mesti set what is our objective. Itu is the main thing. Kemudian, They will go futher, explore and they get their own knowledge. And after they perform, what they get and they perform so that kita akan nampak macam mana diorang bina their own pemahaman darisitu, maca, macam dalam web ni, dia ada version dia yang pertama. Dari situ kita boleh analyse dia,apa, dia punya version tu, apa yang dia construct based on dapatan dia. Kemudian, the real one datang, apa yang berlaku dalam networking. And then, baru diorang revise balik.
Q	Right. Do you, apa nama, label that, or categorise as the constructer verse approach to the assignment?
A	Macam mana kenangan you?
Q	Huh? I don't know.. I mean, there are a lot of people banyak .. you know.. restruction.. dalam Constructivism.. Because I think Constructivism is loosely use in education technology cuz because of the connection kan? Banyak orang kata is like if you are using technology therefore you are

	Constructivism already. You know, ada orang kata macam tu. Ada yang tu another extreme kata, you pakai teknologi, teknologi la. Maksudnye, Constructivism is just an approach. It's one of the strategies to use technologi. Ada juga yang go to that extreme, you see? So, urm.. yeah, depends on people.you know what I mean? It is realy quite difficult.
A	How do you look, at this?
Q	Well, urm..in a way it is, because, you're explaining it to me, like it is version one, two and three, That was just outrages to me. The idea scare holding sort of approach that you was so soon to discover, and explore the technology themselves. And then build something, and then, receive more input, I mean, that is a guided ni kan? And then, they get to revise, and then, and they get to look at it again. That means they is again questioning their nya, apa nama, knowledge and their also understanding and at the same time you are forcing them to, urm, apa nama.. evaluate, you know, level mana yang dia rasa dia are at lah.. And then the last version would be your version yang version you akan tengok and assess lah.
A	And then actually, the third assignment dia kena betindak secara consultant.
Q	Right.
A	So then, dia bertidak dalam sebagai consultant, it means dia kena, apa, menguasai apa yang dia cadangkan. So, this one actually, kalau dia tak dapat membuat tugasan pertama dan kedua, dia takleh hasilkan the third assignment.
Q	Right.Right. I see.
A	So, This one is progressive.
Q	Yeah. Progressive. Yeah, yeah, yeah.
A	So, macam dia kena pergi kena jumpa dengan the real people. Dia tak boleh just refer dengan apa yang dia dapat dalam internet je. They have to go an interview the real people.
Q	One thing I want, curious about, macam version one. Do you get them to

	share among each other. Like, do you let them to see what each other is doing?
A	Yes, yes. They present it.
Q	Owh, okay. Right, right.
A	So, they present it. Okay, masa diorang present, I and, urm.. that one.. I introduce them to satu filem.
Q	Right.
A	Okay. So, this is, aa.. Warriors. Actually, this one is, urm, kita tunjuk pelakon-pelakon utama dalam dunia networking.
Q	Okay.
A	Okay. Tapi in technical. (Sounds like tv was on) So, they orang preview. They orang tengok yang ini. And bila diorang tengok, and then, they nya session la.. I present this one, and lepas tu diorang tengok. Lepas tu, dua kali diorang tengok. Kemudian, ada presentation, all the four take.. And then they looking at back here. (sounds of TV narrating) So, this one is more technical la.
Q	Yeah. Warriors of networking eh?
A	Yeah. (More tv) The dorm of the net.
Q	Hehe. (more tv and phone beeping)
A	Kita nak pahamkan.
Q	This is interesting actually. Where did you get it?
A	From, from the net.
Q	Urm, is there any social software besides blog? You know, any other social software? Web 2.0 punya tools.
A	(TV was muted) Sorry, what do you mean?
Q	Macam web 2.0 punya tools. Like..

A	Kalau yang biasa tak adalah. Guna yang biasa je lah.
Q	Right, right. Urm, apa lagi nak tanya ya? Like, going back to Constructivism tu tadi tu. Urm, I'm seeing like they are banyak pelajarlah, macam salah guna tau konsep macam sketch holding tadi. Movie making, you know, exploration like that, you know. Macam diorang kata, guna mouse je tu dah interactive. You know. Do you see that in you class room? You know what I mean? Is the, macam miss connection with the actual term and what they are using in the classroom. Do you see that happening?
A	I tak nampak tu. Tak nampak. Cuma yang I dapati ada, ada, diorang suka explore tapi at the same time, macam kata, ada banyak kursus yang bagi ni, diorang jadi active. Macam ape, this assignment kena explore, this assignment kena explore. Maksudnya, they don't just refer to my course saja. They refer to other course. At one time, bila I nak buat this kind of approach, I pikir balik. Kesian jugak kat diorang. Tapi, kita nak juga dia belajar. If kita saja yang nak bagi this, this info, dia tak akan belajar jauh. Macam this one student, yang I kata tu jadi webmaster tu, okay, dah memang cara dia begitu. Okay, and then, we try bagi fitting. Cume apa yang lebih dia, dia interact dengan dia punya yahoo messenger. Bila ym, ustaz, ada tak tempat bagus untuk nak tau tentang untuk network ni? Ya, kita bagi. And then, ada tak orang yang ustaz tau, orang yang bahagian network?. Bila macam ni, dia develop. Kemudian, student pandai out source.
Q	Aaah, I see.
A	It depends on how student to lihat lah. And student ni ada dia punya perspective masing-masing lah. Kadang-kadang dia ingat kita bagi kerja macam ni, dia ingat pensyarah tu malas. Kan? Ada juga perception macam itu. Kata contoh, ni pergi sini. Buat ni, cari. Rasa macam pensyarah tu malas nak lecture kita. Bagi kerja je. Itu kita kena ubah la. Dan ambik masa , masa lah.
Q	Di, di kelas contact, with your students..How many hours lecture?
A	Three hours.

Q	Three hours of lecture. And tutorial?
A	Hurm, Direct, direct. Three hours tu.
Q	Right.
A	Termasuklah lecture dan those tu, hands on tu.
Q	Right.
A	Selalunya 30 minutes tu I given instruction and semua tu .And then kemudian I let them go, go.
Q	Owh, Okay.
A	Vice versa lah, macam mana cara dia, the content of that day.
Q	So, it's one shot? Satu hari sajalah?
A	Satu hari saja.
Q	Oh, I see.
A	Letihlah. (laughs)
Q	Yeah, it must be exhausting. Semalam pun saya duduk kelas Dr. Raja. Empat jam. Daripada pukul 9 sampai pukul 1 kan? One stretch. Kesian saya tengok. Penat juga saya tengok, you know, muka students. Okaylah. Urm… Saya nak tanya pasal, urm, problems in terms of using technology in the classroom.
A	Satu, is the tools that we expect to use, to benefit from it tak dapat function.
Q	Right.
A	Itulah. Okay, kata, kata kita dah rancang macam baru ni lah. Taiwan ada earthquake kan? Kita dah rancang untuk diorang explore. So, internet down. So, kita kena buat kita punya free time la.Masalah-masalah yang berkaitan, itulah je. Tapi as a educator kita mesti adalah backup. Supaya senang.
Q	What was the, about the use of technology in the classroom, do you see the students having problems when they finish your class, katakanlah dia nak balik ke sekolah nantikan, do you think what, what kind of problems do you

	think they will face in terms of what content yang you ajar dalam kelas.
A	Okay, dalam contoh merujuk kepada web dan perangkaian. They will get, maksudnya, apa infrastruktur yang diperlukan. They will know, they know how to manage it. Maksudnya kalau ada computer yang kat sekolah macam mana diorang nak modify dan guna untuk networking. Okay, cume kemungkinan mereka akan dapat infrastructure seperti yang terdapat dalam yang the ideal one. So, they have to replace it. Sebab tu dalam persediaan khusus ni kita melatih agar mereka bersedia dalam keadaan begitu. Macam mana. Dan bila diorang pergi interview, dengan mana-mana syarikat dan personel semua, diorang akan nampak dah, 'Oh, yang ni macm ini dan yang ini macam ini,' Kemudian representer terangkan,'oh, ini keadaan yang dia akan hadapi' Kemungkinan tak seperti mana yang kita dapatlah. So, we have to face. Tapi, the foundation mereka ada.
Q	So, basically you address that problem, and that issue in that second tugasan lah?
A	Yeah, that second.
Q	Urm... I see..
A	Kalau tidak, dia mengharapkan suatu yang ideal. So, bila dia kat sekolah, dia tak boleh apply.
Q	Right.
A	Kemudian, bila dia tak boleh apply,maksudnya, useless lah.
Q	Right.
A	Apa yang dia belajakan? So, kita nak tengok yang the real one. So, dia kena pergi interview dengan orang yang berkenaan, dan tahu apa rasanya, the real situation.
Q	I see.
A	Kemudian, the real people coming to the class. And explain to them.
Q	Yeah, that's good.

A	Rather than kita semua just ajar the teori and all the teori, and then dia keluar sekolah, 'dulu belajar ni, tapi macam mana nak guna ya?' Yang itu kita nak elakkan tu.
Q	What about your final exam? What do you cover?
A	Urm, cover basic knowledge. A few terms yang berkaitan. Kalau dia tau, memang, memang sepatutnya dia tau lah. Dia tak tau maksudnya dia tak go, dia tak, tak gali apa semua lah. Kemudian definitely ada question tentang application, macam mana dia fill apa-apa saja lah. Theory and application la..
Q	Basically, theory.. I see.
A	Yang itu basically kita bagi kes la. Kita bagi kes and then depa explain.
Q	And than how much weight does that carry, the final exam?
A	Forty.
Q	Right. And the assignment tadi?
A	Sixty.
Q	Sixty.Right. Did you have, urm, any serious failures in the course?
A	Urm, Tak ada. Cuma kita kena ada aware of passenger.
Q	Right. That happens kan dalam group work.
A	Macam soalan dalam ujian pun kita tengok kita bagi dari satu sudut teori dan satu sudut application. Kalau teori je tahu, maksudnya, application dia tak go. Okay, than maksudnye dia tak apply the knowledge. Vice versa la.
Q	Kalau dia passenger memang dia tak boleh jawablah kan? (laughs)
A	Tak boleh jawab ar. Kemudian kita bagi terbuka. Apa-apa kita bagi tau. Kemudian dalam masa perbincangan, I do ask them. "so, you cari apa dalam untuk tugas ni? Dia kata, aah, bahagian ni saya cari, dia kata." Kalau ni, "aah,aah, okay.' Kita kata usaha kuat sikit kita kata,

Q	(laughs) Kalau lama skit "aah,aah' tu (laughs) I see. Okay. I think that's it actually.
A	Yeah.
Q	Yeah. Do you have any questions for me?At all, kalau…
A	Tu lah, macam mana do you proceed what I'm doing? Is it constructive?
Q	Or it is, if course. It does look at it is. I need to look at, umm.. the, apa nama, the assignments and see how the students are ape nama, addressing…
A	Performing?
Q	No, Bukan performing. I'm not looking at their performance. I'm looking at how they approach tye assignments, you see. Cuz' kadang-kadang kita kata,..
A	Nampak macam ni..
Q	It's macam ni, tapi di kata nampak lain tau. Nanti I, I've seen that in USM. I'm not suppose to discuss that tapi..
A	Betul-betul..
Q	Tapi yerlah, you know, kita sebagai pensyarah, kita macam tengok, we want them to learn in the certain ways to see that they are expose, you know. Kadang-kadang student bagi feedback macam, aaah,aaaahh.. Ikut je jalan macam ni. Therefore kita dapat markah yang kita patut dapat, betul tak? Kadang-kadang..
A	Kadang-kadang ada benda yang kita boleh trace.. Ada yang macam tu.
Q	Itu lah.. Yang sedihnye.. ramai macam tu..Saya, the reason I'm doing this course ataupun this topic pun is because of that. I myself is frustrated. Masam saya mengajar di Unimas. Apa nama, student, betul-betul la saya bagi kat dia. Nak ajar, so you know, you try this and you try that and bla bla, bla.. Kat sekolah dia tak pakai pun. Dia kata buang masa je suruh ajar. Macam , takkan buang masa I cakap kan? This is good knowledge. This is very new technology I kata macam tu. Kenapa tak nak buang, I mean use a

	little bit of your time buat, apa nama, explore a little bit with our students in the class? Dia kata 'oh, kena cover benda dalam syllabus'. Itulah reason yang paling banyak. Kena cover syllabus, guru besar tak tengok brape banyak kali dia guna makmal. Therefore it is not a performance, apa nama, a merit tau for them.
A	Lagi banyak kerja la diorang kata? Haha.
Q	Exactly. More work than anything else. You know, if they do the minimum work they always do, they get the same pay. There's no incentive for them to work out of the box. You know what I mean? I need to find out whether we are doing it wrong ke dalam education punya aspek kan? I don't know are we doing it wrong or wright ke, I don't know. So, I thought this was a goon opportunity to see ither work, other colleagues in the same thing, tapi, in other universities. Are we seeing the same patterns or, you knw, otherwise. Saya buat research pun pasal cikgu pakai technology dalam kelas. Jadi macam kalau kita pergi dekat, urm, sekolah kat Malaysia ni, kalau kita kata ada visit diorang pakai ni, baru diorang nak pakai. Duk tiap-tiap ari tak pakai pun.
A	Macam you mention ni ada benar. Macam kita introduce apa ni, smart vault. Macam ada certain skolah kecik sangat ada smart vault. Yang lain dia kata dia tak guna ja.Tapi kita nak, nak, nak kemukakan bahawa bukan tak guna apa yang belajar. Bila you guna ni. Ni adalah satu benda ilmu, kalau tak guna, you ada ilmu, ni adalah satu benda yang baik tau. Bukan you lasung suatu, apa orang kat, tak berilmu.Orang yang berilmu, dalam Al-Quran kata, orang berilmu dengan orang yang tak berilmu adalah orang yang tak sama. Okay. Tak sama.
Q	Ya.
A	So, kata, if you're tercampak di suatu sekolah yang yang ada smart vault. Fine, you are already there.
Q	Ya.
A	Rather than,"Owh, ni apa benda. So, I slalu teruntamanya untuk student

	yang baru start ni" I barely open their eye on technology. Technology ni you boleh advance your, your…
Q	Itulah.. Kadang-kadang saya rasa macam rasa kita mungkin terlalu optimistic mungkin in terms of, macam kita kat dalam university. So, funds kita memang lah, lebih daripada apa yang kat sekolah. Yang kita nak student, you know, dia dating kelas, dia belajar dengan kita, dia balik ke sekolah, dia boleh apply apa benda yang kita ajar. Tapi apa nama, ramai yang ambil jalan mudah. They do the most minimal things and that is enough.
A	Itulah,, itu yang kita kena bagi tau, , bukan yang kita kena bagitau , kita kena open their mind. maksudnya It is very beneficial. Amat-amat penting untuk dia menmanfaatkan teknologi ni. Sebab saya nak diorang perceive urm, bukan alat. Kalau diorang perceive teknologi sebagai alat, alat you nak guna, tak nak guna tak ada apa.
Q	Right.
A	Tapi bila you guna, it enhances your job. Okay. Tapi saya nak diorang tengok itu sebagai satu ilmu. Bukan kata dalam islam maksudnya, ia sebagai satu hikmah, alat kebijaksanaan. Kalau orang yang bijaksana, dia akan manfaatkan segala sesuatu yang boleh memberikan kelebihan kepada dia.
Q	Yelah, yelah. This again goes back to the principals of using your creative and thinking skills. You know, cause it forces you to do that. In using the teknologi it forces you to try to explore. Yeah, but the little burden yang diorang nak…
A	Dia lihat, ' aku kerja banyak tapi aku gaji sikit.' Yang kita nak ialah kita bukan nak tengok dari sudut tu. Yerlah. Kalau kita tengok dari sudut tu, duit banyak mana pun tak cukup.
Q	(laughs)
A	You kerja teruk mana pun, tanya jerlah orang yang gaji banyak pun, duit pun tak cukup jugak.

Q	(laughs)
A	Yang penting ialah, you rasa puas hati.Seronok. You bagi sorang satu ilmu, dan dia dating manfaatkan ilmu tu. Itu the best thing.
Q	Itulah. I keeply, you know, agree with you. Tapi itulah, kadang-kadang sedih tau.
A	Kita tak boleh menidakkan. Benda tu lumrah, dah jadi lumrah.
Q	Ya. Itulah. Bila kita ke UK ni, rasa, apa nama, how materialistic Malaysian people are. It's quite sad actually. So, tapi yerlah, it's like relative what you said. Like, you know, lurah already, you know. Semua orang dah…
A	Kita kena.. out of the box..
Q	Ya, ya. Think outside the box. Yeah, yeah.. Itulah dia. Itulah saya berangan-angan nak buat thesis ni.. Itulah dia (laughs)
A	Insyallah

APPENDIX F Translated Interview Transcript (MSTE2)

Main Study: Transcript of Interview with Teacher Educator at University Z (MSTE2) – Full English Translation

Source	Data	Key Concepts
Q	Okay, could you please, introduce your academic background first. How did you come about to teach this course, this [teacher education] programme, [this] educational technology programme.	
A	Okay, I came here for an interview, and then I was offered a teaching position to teach Information Technology. My [academic] qualifications were in TESL (Teaching English as a Second Language), and my Masters was in Educational Technology..	Self Introduction
Q	Alright. Where did you study?	
A	UKM. But I completed my Masters degree here [Universiti Z]. And Dr X was my Masters' supervisor. When I came in to work at Universiti Z, this Educational Technology course was assigned to me because I have taken courses in Educational Technology under the tutelage of Dr X.	Self Introduction
Q	How long have you been here?	
A	Here? Since 2003. So it has been about three years.	Self Introduction
Q	You mentioned you were asked to teaching Information Technology. How would you rate your own IT skills, in a scale of 1 to 10, 1 being very poor, and 10 being excellent.	
A	Perhaps it would be...[paused] a 7. I think that is sufficient. I am not a very technical person, so I think 7 is the best choice to	ICT Self-rate

	describe my IT skills. I am more inclined toward research-based skills. And I like doing Instructional Designing...which is less technical...(laughs). I am still learning the technical skills though.. (laughs)	
Q	How would you...if you would rate your confidence, in terms of teaching IT? Again on a scale of 1 to 10 in terms of your confidence?	
A	How would I rate myself? I would say that the scale would be between "Not having any confidence" to "I can survive anything". To me, it is a learning process. We learn together, we do things together, everything is done in a group. I learn as much as my students, because I am not an IT-person [doesn't have academic qualifications in Information Technology], and some of my students are coming from the Information Technology programme here at University Z. This is particularly true for my Masters-level students. I think we are all learning together. To me personally, I am not just teaching, and I am not just a teacher. I take up the role of a facilitator, because I feel I learn with my students. We build up what we know and we learn together as we strive through the academic semester.	ICT Self-rate Justification for ICT Self-rate
Q	What about learning styles? In terms of trying to identify or address students' learning styles, you know... in class? How do you manage to do that?	
A	I use group work format most of the time. I would normally address the students in their groups. For the weaker students, I would advise them to learn from those who excel in their own groups. The pattern is that, when the students have a poor grasp of IT skills, they find tasks	Perception about Teaching Educational Technology

	that would help them master the skills on their own. Some would enrol in other IT courses, some would learn from their friends. They do not rely on what I teach in my class. So I guess I am giving them, not merely lectures or class tasks, but more explorative studies, which I think suit them better.	
Q	What about the individual competencies, how would you address that?	
A	Individual, in terms of technology? Those who are facing problems in understanding what is taught in class would normally come to my office and meet me on a one-to-one basis. This is on top of what I would provide as consultation in class.	Tackling comprehension issues in Educational Technology courses
Q	Your class, it's very small, yes?	
A	Yeah. Very small.	
Q	What is the maximum number of enrolment, in a normal semester?	
A	The maximum so far is thirty plus, and that was years ago. It is just enough to occupy one lab session [which accomodates 30 people at any one time].	
Q	The whole idea about this research is to identify and understand issues faced by teacher educators and students, who are teaching and learning Educational Technology in Teacher Education programmes. We want to find out the issues regarding teaching and learning, and if there are gaps or problems in the	

	way teaching and learning is addressed, we can address the issues in a systematic manner. In this research, we want to find out how the student teachers are going to use the knowledge of we are teaching them [in these Educational Technology courses] and how they plan to transfer that knowledge into the school context. I am testing out this framework [the adapted TPCK framework is visually drawn and shown to MSTE2 at this point]… It's like…[sounds of scribbling on paper]… The framework is actually goes like this….There are three main aspects in the framework – Content Knowledge, Pedagogical Knowledge and Technology Knowledge. Let's say we focus on Content Knowledge first. In Shulman's theory (the person who came up with the original idea behind this framework), he claims that if we have Content Knowledge (which denotes Subject-matter Knowledge, or Discipline-specific Knowledge), it says that if we have Content Knowledge, it is not a given that we have Pedagogical Knowledge as well. So similarly, if we have Technology Knowledge, it does not presuppose that we have the other knowledge types as well. The overlapping areas here [showing the framework] shows the areas in which these knowledge types merge and meet. We need to have the overlap of these knowledge types in order to deliver effective instruction using technology. This middle area here, [pointing to the TPCK sector in the framework], is the knowledge type that is recognised to be ignored in many teaching instances. This framework is introduced to indicate that the three knowledge types need to	

	complement each other to make instruction effective. What I am interested to know is how we address the teaching and learning of technology, in Educational Technology courses as a subject within the teacher education programme. If you can reflect on how you teach this course, how you addressed the use of technology in the teaching of a specific content area, and how you addressed pedagogical knowledge when teaching the topic. How did you do it in your own course?	
A	Okay, basically, it's like this…. If I can take an example of my students from the previous year's class, I had students who majored in Religious Studies and Early Childhood Education. For Content Knowledge, specifically for the Religious Studies major, they would use content from their own courses in the Religious Studies programme, for instance, Arabic Language, topics on Hajj, and so forth. Similarly, for Early Childhood Education majors, they used content from…teaching Kindergarten children… They already have Content Knowledge when they came into my class. Therefore I would not focus on Content Knowledge at all in my own class. I focus on Multimedia, hence I focus on getting them to produce their own [multimedia] products. I focus on that most of the time…	Perception about TPCK in own Educational Technology courses Addressing Content Knowledge
Q	How do you do that, how do your class in terms of in your lecture, and in practice? How do you get them to start working on the production process?	
A	How do I get the [TPCK] knowledge? Something like that?	Perception about TPCK in own Educational Technology courses

	For the classes, I have already prepared tutorial packages for all students. It's like this: How do I teach converting Powerpoint slides into a courseware. I have prepared a [tutorial] package for them [to show them how to do it]. The package consists of a Compact Disc and a [printed] manual. I would lead them into the conversion process using the five stages....using the ADDIE model...Analysis, Design, Development...and the students had to show me every part of their construction process. The students were also asked to keep a personal journal [to document their learning process]. If they encountered any problem, they were encouraged to inform me...	
Q	Oh, do you look at their journals?	
A	The journal is like... every week I went through and checked their journal's progress.	Perception about Teaching Educational Technology
Q	What about Group work in your class?	
A	Yes, so it's very compact. Really packed. It's very small, so you look like you're relaxed, right, I continued teaching last week, so this week, okay, I asked them to work further on [their multimedia] production...	Perception about Teaching Educational Technology
Q	When you teach this course, did you find that some of the Content Knowledge materials cannot be addressed (in terms of converting them into multimedia products)? How did you deal with issues like that in your class?	
A	Yeah, I did encounter the problem... with Religious Studies content. For instance,	Addressing Pedagogical

	the way to count...what was it...I have forgotten..but there was one topic on this, right? When the students use the Multimedia Builder software, normally we can add different items when building the multimedia content, but we had to resort using other software when dealing with the Religious Studies content materials...	Knowledge
Q	Right, did you demonstrate to the students how to use the alternative software programmes...or...or...	
A	No, no. I just organised a discussion with the students, because of the small number of students in the group project. We discussed how to teach parts of the selected lesson, so what we did was to choose one easy chunk of a topic that the group has selected, and we discussed how to use to a graphic creator application, or any other application.... The students did not have IT skills, so I suggested they linked the materials to MS Excel....	Perception about Teaching Educational Technology
Q	Okay. Besides Religious Studies, what other subjects have you had to deal with for Content Knowledge? What are content areas have you dealt with?	
A	I did...design shapes, instructional design (which is one of the courses I teach), and also Basic Technology, and Multimedia.	Perception about Teaching Educational Technology
Q	All, at undergraduate level, yeah?	
A	Undergraduate.	
Q	What about pedagogy? How is it addressed in the lectures or in the courses	

	itself?	
A	OK, Pedagogy...you are looking at the Domains of Learning, yes? Taxonomy? All of that? In my class, the Multimedia course, it was part of what I worked on in my Master's thesis. I have asked the students to divide the class into groups, with each group consisting of three persons. What you learn cognitively, I would give them the skills. What you learn affectively, I would give them all that...	Perception about Pedagogical Knowledge
Q	Do you mean to say that the students are learning to identify?	
A	Yeah. Yeah they identify the way to use multimedia...	Perception about Pedagogical Knowledge
Q	How did you merge the knowledge to identify multimedia products with the skills to use the actual technology?	
A	Okay, for example, Technology, we can look at the students' interests too, right? Affective...their interests can be seen from one thing, the [multimedia] product... And then, there's the journal, the students would write...for example, if I say I want them to use a tool, like, how to create a link to Multimedia Director...from Multimedia Builder, the students can describe the process of finding out how to do the link creation... for instance, they would ask from their friends who are studying Information Technology...To me, the writing in the journal would suggest the students are keen to learn about the process...that they have an	Understanding: Pedagogical Knowledge

	interest about it… and they are willing to make the extra effort to find out how to create the link [from one application to another]…	
Q	Right. How about the guidance that you give during the lessons?	
A	Okay, I used the [tutorial] package that I have created. The students would come and meet me individually or in the groups they belong to. In these class meetings, the students would show me their storyboard, amendments to the multimedia product that they have been working on, and I would review each issue one by one. That is the normal strategy that I would use with them in class. The students work in small groups. The tasks are divided among them in their groups. I usually check their journals and storyboard to find out what and how the group has amended things in the product. When they are done, they are asked to prepare a slide presentation to illustrate their progress in creating the multimedia product.	Perception about Teaching of Educational Technology
Q	Right. How you evaluate them, then? Their performance in the course?	
A	Evaluate their performance?	
Q	Yes.	
A	At the end?	
Q	Do you evaluate them at the end of the course or throughout the duration of the course?	
A	At the end. I evaluate them at the end because I just want to see if they have	Perception: Success in student learning Educational

	digressed in the process.... To produce something like the multimedia product, it is a difficult task to undertake, and sometimes the product is not up to your expectations. Because it is hard process, I have to monitor the students' progress....	Technology
Q	How many assignments do you give out, in average, for a course like this, which uses applications?	
A	Applications, usually I would differentiate the categories of applications, for example, MS Word would fall under Word Processing. For example, using the tools of Word Processing, I could ask students to design something and print out their product. Normally I would use classifications like Word Processing, Internet, Publisher and Powerpoint. Powerpoint is a combination of all other tools I mentioned earlier. When you produce a courseware, you also get to present it, all in one shot...and then that is all for your tasks.	Perception about Teaching of Educational Technology
Q	Let me recap. You mentioned two software applications per category – what do you assess in a course like this? Do you assess their performance per application? For this [multimedia product], do you assess two applications that were used in the project?	
A	Per courseware? I only assess one courseware only. And the students would present their work for the assessment. Besides looking at the courseware, I also look at the students' presentation style,	Perception about Teaching of Educational Technology

	content, and anything they have built and presented in the courseware….	
Q	Do you conduct any final exam for this course?	
A	Yes.	
Q	What are the things you test in your final exam? How do you incorporate the technical aspects of multimedia production.	
A	[The final exam does not] consist of technical knowledge at all.	Perception about Teaching of Educational Technology
Q	OK Right.	
A	It is more application-based, what they use, whatever tools they have used in the applications, pedagogical purposes...	Understanding Overlapping Knowledge types
Q	Right. Could you clarify, do you address any pedagogical knowledge or any pedagogical elements within this course? I'm not too clear about that.	
A	To me, [giving] lectures is like giving technical [knowledge]...giving technical [knowledge]. So, to me that is pedagogy...you just said, I am teaching [it]....errr...	Understanding Technology and Pedagogical Knowledge
Q	Let's say, if we look at one of the topics in your course syllabus here, one is called "Application of Technology in Education". Can you describe how you address the pedagogical knowledge aspect in teaching this topic? How do you incorporate Pedagogical Knowledge into the courseware production process? Or is this something you leave out from your course entirely?	

A	The students are producing something that relates directly to teaching and learning, so when I check their progress every week, I would address elements like…target group…If the project team decided on a range of target group users, they are expected to learn how to teach the target users….because I am not teaching the students that…. Somebody else is teaching them that… What I do is, I would ask the students to incorporate what they have learned from other courses about how to teach the selected target group users…. That's how [I do it]….	Perception about TPCK in own Educational Technology course
Q	So, there are no explicit details [in how you address Pedagogical Knowledge in your own course]?	
A	No, I don't teach them explicitly... No. The students understand this, and they would ask, "Oh Madam, is this how it is done?" and I would reply, "Yes.." When they expect Technology Knowledge, I tell them to design it themselves, and they cannot do things at random, for instance the selection of colours, accessories, whatever they use, because every choice must be based on some [theoretical] principle. The students have their own principles too, about how to go about doing their project. They have to explore their own principles. The Pedagogical Knowledge comes together [with the design of the courseware]. I always treat it that way… I do not give a lecture, and I do not stop them from exploring their ideas by telling them off if they seem to go off track….I cannot.	Perception about TPCK in own Educational Technology course
Q	Yes, it seems like that is your teaching	

	style. It's the way you address Pedagogical Knowledge. That was why I wanted to identify at which point in the course you think you address it.... Because I do it differently [in my own classes]. The way Pedagogical Knowledge is treated is...completely different...	
A	Is my answer correct...I'm afraid of giving wrong answer....?	
Q	No... no... no... There's no wrong or right answer [to these questions]. It's a matter of teaching approach, isn't it? Urmmm...one more question, I think you do realise that there has been a lot of talk about using Constructivism in the teaching of Educational Technology. What is your position on that?	
A	As a teacher, I think we need to use it most of the time, right? For instance, encouraging students to construct their own knowledge, all those stuff...(laughs)...Basically what I teach, most of these (referring to her course syllabus)...most are Constructivistic....	Understanding about Constructivism
Q	Do you think it's something that teachers should know about and use?	
A	I think, teachers should know about it. As part of their teacher knowledge, they should know about it. But, to use it, it really depends on what you teach...and your students... For example, when I was a teaching in a secondary school [before teaching at University Z], I could not use it...definitely cannot use it.... I had students who were dyslexic....you know how it is...[laughs]... However, in this course, and the types of students I have, I can implement	Understanding about Constructivism

	Constructivism in my lessons…	
Q	What about the students that you have taught before? Have they ever come back to ask you or told you about [how they] use Constructivism in classrooms around the country?	
A	Oh, no, they didn't. They didn't know about Constructivism.... They don't realise the use of the theory.	Understanding about Constructivism – How it is used in class
Q	Right. Do you think Constructivism can work in schools?	
A	Constructivism? It depends on the students, because when I was teaching in schools, as a teacher… Are you asking me from my point of view as a teacher? This happened quite a while back… I was teaching English Language…We had a very poor English Proficiency group, and we also had an advanced level group…. I was teaching at a Convent School [which normally has students who are competent in English]. With the advanced group, yes, I could use Constructivism, but for the poorer level, you need to create….you know…the environment…	Understanding about Constructivism – How it is used in class
Q	How about the teachers that you have taught, those who have already graduated from University Z? Do you think they are teaching using Constructivism while using technology?	Understanding about Constructivism
A	Constructivism for teaching using technology?	
Q	It's ok if [you] don't know...	
A	Aaaahh…[I] don't know. But if, er, oh, [I] don't know. [Be]cause...[they] have already finished… [they] have already finished…	Understanding about Constructivism

Q	That's alright. Do you think it is necessary for teacher educators to teach Constructivism at university level while training teachers? Should we include Constructivism in our teaching?	
A	I mean...you mean... in letting them know.. Okay, Constructivism… errr...	Understanding about Constructivism
Q	Basically knowing the principles, and utilising Constructivism [for teaching and learning]…	
A	OK....I never thought of it.... because it's embedded...in the course... (*laughs*).... It might be useful also, you see…because, when they create their own lessons, it is like more valuable to the students and they enjoy doing what they like, you know, and they learn a lot....technically of course... let say the language, the content....they would learn together with it....	Understanding about Constructivism
Q	I see.	
A	Building something that they would remember better....	
Q	Hmmm, one of the things that I found [in my research is that] a lot of people misuse the principles of Constructivism… For instance, by just holding the mouse, they classified the action as "interactive".... you know what I mean? Combining slides like together, for instance, slide 1, slide 2, slide 3, and linking them to each othe...it said that it contains the "scaffolding" element. Do you understand? I think there is a lot of misinterpretation of Constructivism in terms of using it with technology. Do you see that in your own courses? That's what I'm curious about.	Constructivist Elements: Use of jargon

	In terms of your own students, those that have graduated, those that are teaching in schools, do you see the same phenomenon here in University Z?	
A	Misconception? Errrr... at one point, I did ask them to include something "interactive"... Interactive to me is...if I can describe it...the courseware would give a response...and I would show them examples of what is deemed interactive... There should be some kind of interaction between the user and the courseware. After the explanation, I assume the students understand my expectation about Interaction...	Constructivist Elements: Use of jargon
Q	To summarise what you just said, you demonstrated your expectation, and the students copied the demonstration and duplicated it into their work, yes? What about the other tasks they do in the courseware development process? Do you detect misunderstanding or lack of comprehension?	
A	Yes.	Constructivist Elements: Use of jargon
Q	How do you counter that?	
A	Those who do not understand – sometimes I would get them to approach the issue in their groups. I think it is easier to handle the problematic issues that way. I normally work through one group at one time. When I assess their work progress, and if I detect loopholes, I immediately sort them out with the respective groups. Sometimes, with the students who do not understand some parts of the course, I would have an analysis first. Sometimes, the students do not even know how to	Constructivist Elements: Use of jargon

	write learning objectives. Learning strategies… Goals… [Before coming to my course] I think they should be able to…This is one of the things I do not know how to deal with….	
Q	I see.	
A	In my view, if you do not have Learning Objectives spelled out, you will find it difficult to introduce your courseware lesson… So what I would do is to correct the process from the initial point of design…the students cannot find their mistakes and they do not know what to do…and what next steps to take… So what I would do is to correct the construction process from the very beginning…	Tackling comprehension issues in Educational Technology courses
Q	I see. And then you monitor the group's progress from the beginning...	
A	Yes.	Tackling comprehension issues in Educational Technology courses
Q	This is the final question I have for you. What kinds of problems do you personally face, in using technology here, at this level of training teachers to use technology?	
A	Pre-service teachers?	
Q	Yeah....What kind of challenges that you see right now?	
A	It varies... From one batch to another....With this particular group, I don't have much problem in terms of technical [knowledge]. The previous one, yes. When I taught Powerpoint to the previous batch, I have had to teach them	Tackling comprehension issues in Educational Technology courses

	step by step...	
Q	I see... Do you consider problems being just the technical problems.... or how?	
A	Oh, pedagogical ones as well. Because I need.... As I have already said just now, I would ask them to prepare an analysis first before creating the courseware. The Analysis part is difficult for them to do... On top of this, creating courseware for teaching and learning....You are basically.... You have to prepare a lesson plan of what you want to teach, right? Sometimes, the students could not even produce the lesson plan. Although they have learned how to create lesson plans in prior courses, but they still find it difficult to create one in this course. How do you produce a courseware when you do not even know what you want [to teach in the courseware]? As mentioned by other people in this programme, I have had to teach pedagogical aspects as well... I need to teach it too. When you mentioned pedagogy just now, it's like a big word to me...(laughs)...when I teach pedagogy in this course, what I do is use CALL principles (Computer-Assisted Language Learning)....before producing any courseware, you have to learn about the CALL principles first. When you teach, you impart knowledge to other people. You have to make sure what you are giving to people is the correct version of the knowledge. A teacher basically does that. Now I know, now I realise...(laughs)... that is pedagogy. What I am doing is more implicit, not	Understanding Overlapping Knowledge types

	direct...a lot of misinterpretation there...now I realise this... (laughs)...	
Q	Yes, like what you said just now. Instructional design principles – that is Pedagogical Knowledge...	
A	Yes, yes... because I look at the courseware development process from the Instructional Design perspective... I forgot what it was...right...that is pedagogy....	Understanding Pedagogical Knowledge
Q	Yes, let's say, as an example, you want your students to learn about the solar system. From your description earlier, you would ask the students to look for materials from some websites which describe the solar system. Now, that approach to me is not pedagogical, because there is no pedagogical element embedded in the instruction. To me personally, it has to be a bit clearer than that... in how you have just mentioned it just now. You have to define the target learner group, objectives, timeframe to learn and to teach....	
A	That's it... I haven't thought of it [that way]... [I guess it's time] I include Pedagogical Knowledge...(laughs)... And one more thing, when they do a courseware, you need to know how your activities will be like... let's say...[it's going to be a] counting [activity]....Counting can be considered as a learning objective...A behavioural objective, right? The student teachers would pick the Counting lesson, but they do not know how to address the pedagogical aspect....how to teach Counting. They would ask, "Madam, I learned from other courses, you cannot	Understanding Pedagogical Knowledge

	include too many things [in a lesson]… [I am] afraid [objectives] couldn't [be] achieved later." I would reply, "Look," I said, "it's different".... if you create lesson plan with an instructional purpose... that's for a [specific] classroom... other [than that]... this [is] you [making a] product... it's different... how you do [it]... you will achieve [the objectives]... So, it's different. So, I let them know, classroom orient[ed]... the [learning] objectives are different.... Product oriented... the [learning objectives are] different. Then they know "Oh, I see"…and only then they would know... know the difference. So we do teach pedagogy..	Understanding Technology Knowledge Understanding Pedagogical Knowledge

APPENDIX G Translated Interview Transcript (MSST1)

Main Study: Transcript of Interview with Student Teacher at University Z (MSST1) – Full English translation

Source	Data	Key Concepts
Q	First thing first I would like for you to introduce yourself briefly. Tell me a bit about your academic background, and then how do you came about join this course?	
A	I like this course because my mum is a teacher and also my sisters...	Motivation to study
Q	Your mum's pre-school teacher?	
A	No, she teaches Standard one, Standard two, Primary school [level] and my sister [is] also a teacher, but in secondary school, so [their vocation] [has] influence[d] me.	Motivation to study
Q	Before this, before you enrolled into this [teacher education] programme, where were you before?	
A	I was studying in the Life Sciences Matriculation [programme].	Self Introduction
Q	Did you have any previous experience using IT [before you came into this programme]?	
A	Using IT.... I think, learn mostly by myself, not in class. But when I was in secondary school, we had IT classes too in school.	ICT Experience
Q	Which MRSM (secondary school) did you go?	
A	*XXX*	
Q	Oh *XXX*. How would you rate yourself in terms of your use of IT – say if you can choose between a range of 1 to 10? 1 being poor and then 10	Self Introduction

	being excellent.	
A	I think I am seven.	ICT Self-rate
Q	Why do you say, seven?	
A	Because I have learned Information Technology since I was in Form 1 (Secondary School)... I started using computers to programme, play games, surf the internet...	Justification for ICT Self-rate
Q	And do you have computers at home? Are you using any computer at home?	
A	Yes.	ICT Experience
Q	So you always have that at home. Do you find it easier for you to learn this course?	
A	No, not really. I still have a lot to learn. I am still in the learning process. Not really nothing but [i] have to learn also.	ICT Experience
Q	Right. Do you feel any challenge learning in this course?	
A	In this course...I think so...because I have never done any project on writing stories before, or anything similar to that... In this course, [we have to create the E-book] courseware....from start to finish...everything...and we have to put in all the ideas for the story...	Perception about training of Educational Technology in course
Q	Is this your first Information Technology course in this [teacher education] programme?	
A	No, we have done IT courses before enrolling into this course.	
Q	How many IT courses have you done so far? Is this your second one?	
A	For IT? Yes, this is the second one.	Experience learning Educational Technology
Q	I would like to know from you.... When you use IT, especially in this teacher education	

	programme, do you think you are taught how to use IT for teaching? Can you think back on what you did in your previous courses [in this teacher education programme]?	
A	In this [teacher education] programme?	
Q	Yeah.	
A	Yeah, I think so... because we have to create educational materials for children.... So we learn how to use it in your classes....	Perception about training of Educational Technology in course
Q	Can you give me an example, like..say…if you take the assignment that you are doing right now...the topic is on History...How do you think you would use the assignment you produce in this course to teach pre-school children later when you graduate?	
A	Ok, you can give them to explore the course ware....and the children will learn how to read.... how to learn numbers...right...that's... errrr.. the courseware and lesson plans too...	Perception about training of Educational Technology in course
Q	Do you think you are learning about engaging student?	
A	Engaging?	
Q	Do you understand what it means?	
A	I know, engaging...	
Q	Engaging does not mean *bertunang* (meaning of "getting engaged" in Malay), this is engaging meaning, um...like we want to get students' attention so that the students will focus and concentrate more on the lesson, so that they can internalise the lesson more effectively. Do you feel that you are being taught how to do that in this course?	
A	Uuuhhh..I think so, because the lecturer will tell us how children are like, what they want, and how the courseware should be like... and	Perception about training of Educational Technology in course

	how the learning process will be...	
Q	Can you describe how the learning process works?	
A	How [the] learning process work?	
Q	Explain to me what you understand...	
A	I think it (learning process) must be interesting... it must have tasks.... so that the children will learn and remember…. Right? If the children are not involved in the tasks, they will forget the lesson....	Constructivist Elements – Engaging Critical and Creative Thinking
Q	What do you mean by 'interesting'?	
A	I think computers are interesting because we can use songs... they have games...tasks...and kids like things [on the computer screen] moving...colourful things....right?	Understanding about Constructivism
Q	Ok... How do you think technology itself is interesting for kids, in the most general sense?	
A	I really think so because we can see how children nowadays really love computers, right?..... Children have strong interests in playing games and watching DVDs...right?	Perception about Educational Technology use
Q	Do you think computer can also replace teachers?	
A	Computer can replace teacher..yeah..	Perception about Teacher Role in Technology use
Q	Why not? Logically, you can shut donw a computer, but you cannot shut down a teacher....	
A	Children needs teachers to guide them..[in the learning process]...	Perception about Teacher Role in Technology use
Q	Ok, but you do think computer can guide them as well, right? In this course, you are already the courseware projects to help kids learn using computers, right?	

A	Who would want to teach children how to use the courseware, though?	Perception about Teacher Role in Technology use
Q	Ok... Let's say if we have already created all possible lessons for pre-school learning, do you still think we need teachers?	
A	[Yes we still] need [teachers]..	Perception about Teacher Role in Technology use
Q	Is it? Why?	
A	[Be]cause later, when the students get bored, they have no one to talk to, and computers can't talk back with them, right? Computers cannot interact with children...	Perception about Teacher Role in Technology use
Q	But just now you said computers are interesting..because they have games, songs, tasks and so on?	
A	Yes, it is interesting but children need teachers too....	Perception about Teacher Role in Technology use
Q	Is that your reason to justify having teachers around?	
A	The lesson becomes more interesting when teachers are around. Children can learn to socialise and learn to talk with other people..	Perception about Teacher Role in Technology use
Q	In your opinion, do you think using courseware should be the main event in a lesson, or should teachers do all the talking in the class?	
A	Teacher should talk and teach the children first, and then, they should encourage the children to use the courseware to complement their learning process.	Perception about Teacher Role in Technology use
Q	Alright. In your opinion, do you think pre-school children need reinforcement tasks in their learning process?	
A	Yes. If not, the children would have learning issues when they enrol into Primary school.	Perception about training of Educational Technology in course

Q	Don't you think reinforcement can be dealt with during Primary School?	
A	These days, when children go to Primary School, they are expected to know all the alphabets and numbers already...so that is why it is important for them to get a good learning support when they attend pre-school..	Perception about Teacher Role in Technology use
Q	Ok thank you...I just wanted to see how you think about the learning issues at preschool level... Now I have more questions for you... I am carrying out a study to find out how teacher educators and student teachers (like you) teach and learn about Educational Technology in teacher education programmes. In your opinion, do you think computers should be readily available in every class?	
A	I don't think it must be readily available, but its existence is a strength to the class. Computers can provide variation in lessons.	Perception about Teacher Role in Technology use
Q	Do you see computers as a necessary tool for learning?	
A	I don't think it's a necessary tool, but it would be an advantage to have on in a classroom.	Perception about Educational Technology use
Q	OK... Can you name me one pedagogical theory that you have learned in this course, which is related to using technology in the classroom?	
A	Pedagogy is....(*pauses*)	Pedagogical Knowledge
Q	It is the principles we use to make sure students understand what we teach. Pedagogy is the science of teaching. It is a type of knowledge... Let me show you...[sounds of scribbles on paper – TPCK framework is	

	drawn visually for the respondent].... It comprises of all the strategies teachers would use... Approach...	
A	Approach that [a] teacher [would] use…[to help] kids understand…	Pedagogical Knowledge
Q	Hm.. Are you all learning about theories in teaching [in this course]? Did you learn about learning theories? Okay, now [we are talking about] the application of that learning theory. The term we use is pedagogy... do you follow me? Ok, do you feel that you are applying the teaching theories in [developing] this courseware?	
A	Ah yes. I think so. Because we have tutorials right? [In] tutorials, we are using social learning theory because the target group users can use the courseware in groups...or they can access it by themselves.... There's still more to this...	Pedagogical Knowledge
Q	What about a theory called Constructivism, Have you heard of it?	
A	Constructivism… (pauses)…	
Q	What do you think about Constructivism?	
A	I think we have [learned the theory] because before they (*the target users of the courseware*) have already known about animals, right? Then when they use this courseware [that we are building for them] they will [have] input more about animals.	Understanding about Constructivism
Q	Ok… how do you know that these students are building on their prior knowledge? What signals or signposts, anything that you use, to help you identify.... let's say...one student has already understand something.... that he understands the word "animal"...? How do you know?	

A	When the student does a task, if they can provide a correct answer, that means the learning is successful....	Understanding about Constructivism
Q	OK, so what about the issue of assessing or evaluating the learning process.... Let's say, after the student has used the courseware you built, and you would like to evaluate his progress, for instance to find out if he has understood the content, internalised the knowledge within the content... How do you plan for the assessment? What have you learned from this class that has helped you conduct an assessment of learning?	
A	That is why we must have tasks within the courseware, right? So when the students use the courseware, they willt try to remember what they read, and they will attempt to answer questions.... From their responses, we will be able to see if they have understood what they learned... If we just feed them with stories, they would not remember the lessons...	Constructivism: Perception about training to use it
Q	How do you plan to test that (referring to one section of the courseware which is being developed)?	
A	[This] story about animals?	
Q	Yeah	
A	In the tasks, there is one section which will ask the children to spell....Maybe I will prompt the word "habitat", and I will create three categories for the word – marine, land and amphibians – and I will ask the students to choose the animals that belong to whichever category most appropriate for the habitats shown on the screen...	Constructivism: Perception about training to use it
Q	Isn't that an identification task? How would you know if a student has understood the concept of amphibian, for instance? How would you know?	

A	How do I know.... yeah? (long pause)	Constructivism: Perception about training to use it
Q	If you can't answer, it's okay. I just wanted to see how you understand the use of pedagogy in educational technology materials.... Say for instance, one student looks at a crocodile.... Is a crocodile a carnivore? How would you gauge the student's comprehension?	
A	Students would not know details... Or maybe they will.... I think for pre-school level, the students just need to know names, sounds, and where animals live.... That is enough, i think...	Constructivism: Perception about training to use it
Q	Right. Is that your understanding?	
A	Yeah, there is no need to be so detailed [when teaching pre-school children]...	Perception about incorporating Constructivism into Educational Technology
Q	Right, so, what about the idea of challenging student to think [which is a principle in Constructivist theory]? Where would you incorporate that element in your courseware development?	
A	Idea of challenging students....Yeah... when the students attempt the tasks, when they try to remember sounds, and learn numbers....	Perception about incorporating Constructivism into Educational Technology
Q	Right, okay...this is my last question.... How many years do you have to complete this teacher education programme?	
A	Three years.	
Q	When you finish in three years, and you find out where you will be teaching, do you foresee that you will face issues when using technology in your classrooms later?	

A	In class...[pauses]	Perception about Educational Technology use
Q	You must have already seen your mum's classes... Do you think you will have issues about using technology in pre-school classrooms?	
A	Students...not all students could use computers....	Perception about Educational Technology use
Q	What are the problems, you think?	
A	I may have to teach them how to use computers first...and then... uhhh....	Perception about Educational Technology use
Q	At pre-school level?	
A	Pre-school level, yes.... I would need to create simple courseware programmes... which would be easy for them to access learning... they should be interesting, so the students can interact too...	Perception about Educational Technology use
Q	When did you learn to use computers? At what age? In Form One (secondary school)?	
A	Form One…[I] started using computers when I was in Form One...	Perception about Educational Technology use
Q	D you have nieces or nephews?	
A	Yes.	
Q	Have you witnessed your nieces or nephews using [computers].... [Could you] remember the skills that they have now, and try to imagine your nieces and nephews using the courseware programme you are developing now... Do you think the contents will challenge them? What is the challenge for a teacher [like	

	you]…let's say, to address that [level of technical] skills in pre-school kids?	
A	That's why I find kids these days are always more attracted to playing games, right? It's hard for the [teachers], therefore we must make our learning courseware more game-like to suit their interests...	Perception about Educational Technology use
Q	Do you think what you are learning in this course prepares you to face issues like that when you go out and teach in the next few years?	
A	Yes, definitely.	Perception about training of Educational Technology in course
Q	How so?	
A	[Be]cause we have learned our [learning] theories right? Theories....and all the things we do to apply the theories... because when we create courseware programmes...they should be suitable for the pre-school children....	Perception about training of Educational Technology in course
Q	These three years down the road… you know, when you finish this programme. Do you think [all these things you are learning now], [will they be] applicable to you as a teacher then?	
A	Perhaps in the following courses, we will learn more... I think we will not face any problems..except if we have to deal with teaching kids how to use computers first...and then they get to use interesting courseware programmes that we have developed... And we can interact with them...	Perception about training of Educational Technology in course
Q	Ok that's it...Thank you for your time.	

APPENDIX H Interview Transcript (MSST2 and MSST3)

Main Study: Student Teacher at University Z (MSST2-3)

Source	*Data*
Q	The first thing is that if you can introduce yourself, say your name and also what you were doing before you came to this course?
A1	My name is ST2 and you can call me ST2, so I am also local here, so I am doing my STPM before I came into university.
Q	What make you choose to come to this early education?
A1	This is not my choice at all at the beginning because, actually I prefer economics, I choosing the courses, also I think this is my sixth or seventh choice, so when I find out I get this course, I also very confused, whether shall I come here or not, finally I also make my decision to come here. That's why I am here today.
Q	Are you interested?
A1	So... After one semester, this is the second semester, so after first sem I think that maybe I will continue this course. Its quite interesting for me.
Q	And is it as exciting as economics?
A1	Because I did economics at form six, maybe that one, when that time I think that one is my choice for me in the future, so who knows, I also don't know what happen, Ok lah, I find that very interesting. Can educate the child, for me is very very happy ah, meet the children.
Q	What about you?
A2	My name is ST3, call me ST3. I come from Kuching.
Q	I am also from Kuching. Where in Kuching are you from?
A2	Kota Samarahan, near Unimas.
Q	Unimas, Where?

A2	Taman Iban, 17th Mile.
Q	Oh I see the old road la. Where did you go to school?
A2	St Thomas.
Q	I was in St Teresa before. Ok Go ahead.
A2	Sebelum ni saya pelajar STPM.
Q	So you in St Mary school? Where you from were form one to from five?
A2	No, before form 1 to from 5 I was in Kuching High. Then I come to St Thomas.
Q	Oh Kuching High, oh I see.
A2	Then this course not in my 1st choice.Ini juga adalah pilihan ketiga.Tujuan saya pilih ini course sebab emak saya ajar kanak-kanak. So saya rasa peliklah, saya rasa mahu pergi cari kenapa mereka macam ini.Then saya rasa, ...kanak-kanak, then saya ada kaitan dengan psikologi kanak-kanak, saya pilih ini lo but my 1st choice is ...la.Pendidikan....
Q	So you memang interested to go into education? And you completely different?
A1	Ya before that, before I coming here I don't I will become a teacher before.
Q	Now you have to become teacher lo.
A1	Ya, now is quite interesting this child.
Q	The other question I have is about ICT skills, if you can rate yourself, katakanlah, from 1 to 10, one be not very good in ICT, 10 being like excellence, being the best, what do you think you would be rating yourself?
A2	Middle, 5
Q	Why?
A2	Because before that I never use the computer to presentation, only teacher teach in front of us, after come here we use the computer for presentation, I

	just started to learn, start from now.
Q	When is your 1st time to start to learn?
A2	At time, I think is about that say use for presentation.
Q	I see, email and stuff, and what about you?
A1	Maybe also 5, I started in computer when in primary school, because we have computer class, but that time also learn typing all the things only so secondary school learn the excel, power point, … but I think computer also still have many things I don't know la like animation that I am suffering how to do. So maybe challenging also for me.
Q	I see. What you think about the use of technology in school generally? You have been in school, you just came out from school, and you know now being in university you then you gonna go back to school as a teacher, what do you think about the use of technology in school as a general?
A1	What to say. The student also can learn many things online like gather information because a bit out if don't know computer, I think everyone must know how to use a computer; at least basic things have to know.
Q	What about you?
A2	Dalam pandangan saya, saya rasa kalau mahu gunakan computer sebagai untuk pengajaran saya rasa mestilah pandai macam bukan professional understand like that but at least you know how to create the programme that can interesting the student. If you just like prepare the programme like very easy like a for apple then everyone can do it la, so, I think if you make it interesting, I think is good for student la.
Q	If I could ask you to think about what you have learn in this course, do you feel you are being taught how to use apa nama to use the technology in the way you can teach student, not just for presentation? Do you feel you are being taught that in this course?

A2	We just start to learn the power point, never learn how to like teach the student because we just 1st year.
A1	So maybe we will learn in the future we also not sure about our course, maybe like now one of the assignment now is e-story book and then is quite interest, maybe in future we can create a story for our students
Q	Have you have topics on the learning theories?
A1/A2	Yes, Last sem(ester).
Q	Do you think it is incorporated here in this course? Do you feel you are using that in terms of building your story e-books?
A1	Ya
Q	Ya, what do you remember of your theories-theories?
A1	teories-teories like tokoh-tokoh, like the children's mind all that thing la..
Q	You mean like learning teories?
A1	behaviorism, Constructivism, the things la, about the children how they learn.
Q	Are you familiar with Constructivism? What do you understand about that?
A1	I also 1st time I heard behaviorism.
Q	If you remember that, what do you think of that theory?
A1	Like experience, like how to let the kids to learn like as their experience like hands on activities la.
Q	Like what, example?
A2	When you see apple right, if we ask them to write apple, maybe the student only write down or draw out the apple, I think…
Q	Really?

A1	What we understand how to make the kids get use to make them fast remember what we teach, make them in the situation, can feel that kind of situation.
Q	What do you mean by situation?
A1	Like we want to teach the animals maybe we can bring them to zoo, to see the real animals not really show the picture because the picture maybe they can misunderstand la, so when they see the real one they can remember oh that one is lion that one is zebra.
Q	Do you think you are using Constructivism in this course for any of the assignment?
A1	Not really
Q	Ok that's fine, don't worry about it. I am also interested to find out what do you think your lecture expected of you in this course, do you know what your lecture expects of you? From Puan Rafizah...
A2	You mean, faham apa yang diajar?
Q	Bukan faham saja tapi expectation, apa yang dia nak you capai?
A2	Sebenarnya ada sedikit course la, kami rasa confuse, just like seni, right, if seni la I know is seni but the lecture just ask us to draw out they just.. like primary school, but what we expect is how to teach the child to draw not ours to do the works, so very confuse lo.
Q	Is that in this course?
A1	I early childhood education. Because this course computer is our minor.
Q	What I am interested of is in this course, of what Puan Rafizah ajar. Do you know what she wants of you?
A2	So far I can catch what the lecture want la. At least we know actually the lecture want us to know how to do the animation on what la, is very useful

	for the future.
Q	So you think you can use that later when you go back to the source. You know by building this, I also have seen the previous assignment, do you think that, do you feel that there is gonna be any problem you would face when you go out to the … in term of like, you wan to use all the courseware that you have already build, ya, and mungkin, you akan create more courseware later when you go out to teach. Do you feel that you are able to face any kind of problem later di sekolah nanti? Do you forsee that ?
A1	I think probably, got problem la, I also don't know what will happen in the future right. Maybe I also not so good in computer but at least can create something for the kids to learn. So maybe I education is going on la, I also learning ah, although I become a teacher, I also learning.
Q	What about you?
A2	Sebab saya seorang yang tidak suka copy paste orang punya, macam di sekolah, macam tadika saya suka macam berikan cd daripada pendidikan, then saya rasa itu memang sangat …..Kalau boleh create sendiri, interesting.
Q	I want you to put yourself in the shoes of you know being a teacher 3 years on the road, you finish in 3 years time ya...
A1	Hm ah, 4 years.
Q	This is your 1st year so you have another 3 years to go. Now imagine in few years time you are finishing, you are reposted in schools, the kids you are meeting in early childhood is what, under six years old. Now you learn how to use computer at home at what age?
A1	You mean?
Q	For you.
A1	Myself ah, primary I think, primary just start standard 4.
Q	Ok, standard 4.10 years old ya.

A1	Yup.
Q	What did you learn? 1st time you pegang computer. Now the kids are getting younger and younger using the computer. There is a chance that when you go out and become a teacher the kids that you meet, already know how to use the computer.
A1	Because now the kindergarten also have computer class.
Q	You get what I am saying? Katakanlah if you are building like courseware macam ni, do you see is there gonna be a problem in the future, like we go out you see in this student dah pandai pegang computer dia lebih mahu expect more, you know what I mean, your courseware must have to be nicer than Mickey mouse, have to be better than Barney, you know, so do you think there is gonna be a problem?
A1	For me maybe is the problem.
Q	Why do you think so.
A1	Why I also don't know what to say.
A2	Kanak-kanak mereka mungkin masih tidak tahu macam mana mahu berbandingkan lah, saya rasa, mungkin kami buat punya mudah interesting, mungkin mereka rasa senanglah.
Q	What about katakana lah, by 3 years time you all habis, jadi cikgu, orang suruh buat courseware daripada mula sampai akhir untuk kindi, do you think you can replace teachers? Mungkin computer boleh replace teacher?Tak payah ada cikgu....Suruh budak duduk depan computer sahaja....
A1	The teacher also has to lead and guide them.
Q	Why?
A1	I think the communication in between people is more easier.

Q	So why are we learning how to use technology? If you say teacher is can do it better, The teachers can create it better? So why are learning new technology?
A2	We just use it as a alat pengajaran bukan sebagai pengganti guru.
Q	Are you sure?
A2	Saya rasakah, mesti ada cikgu untuk guide them.
A1	If not ah, like kids ah..you let them in front of the computer maybe some of the kids not everyone also know how to use so maybe they just blur in front of the computer. So maybe, a teacher to guide the kids how to start the computer window how to click where, click here, at least also the teacher is to guide them although this computer is the alat pembantu for them to learn more about the technology.
Q	That's all, thank you very much.

APPENDIX I Interview Transcript (MSST4 and MSST5)

Main Study: Student Teachers at University Z (MSST4-5)

Source	*Data*
Q	That's all, thank you very much.
Q	Saya nak tanya pasal, kalau boleh, you all introduce sorang-sorang dulu, who you are, and basically your academic qualifications, and sebelum datang ke University Z ni.
A1	Saya ST4, sebelum ni ambik STPM di Sekolah Menengah XXX. Berasal dari Pahang, anak sulung daripada tujuh adik beradik.
Q	Kenapa minat nak datang ke University Z ni, nak ambik Pendidikan ni?
A1	Saya memang minat untuk jadi seorang guru, dan memang berminat kepada kanak-kanak.
Q	Ada experience jaga kanak-kanak sebelum ni? Mana datang minat?
A1	Jaga adik.
Q	OK – tak pernah kerja dengan nursery ke?
A1	Tak pernah.
Q	What about you? Can you describe yourself?
A2	Nama saya ST5. Bersekolah di Sekolah Menengah Kebangsaan XXX. SPM, STPM. Adik beradik, anak yang kedua, dari tiga adik beradik. Saya datang sini sebenarnya bukan atas kehendak sendiri lah, sebab impian Abah nak salah seorang anak dia jadi guru, masuk universiti, and then, kalau boleh, nak lah jadi cikgu. Pasal minat ni, saya suka kanak-kanak memang dari kecik lagi. Sebab, adik

	saya, yang paling muda, baru tujuh tahun. Jadi saya jaga dia, sebab saya sekolah petang. Kira daripada adik sendiri lah. Lepas tu, kira adik-adik saya pun saya jaga jugak. Saya kakak sulung, so macam minat pada kanak-kanak tu ada lah, walaupun garang sikit.
Q	Dulu, kalau diberi peluang, kalau Abah kata nak seorang anak dia masuk universiti atau jadi cikgu ke, kalau Izna boleh putuskan sendiri apa bidang yang nak masuk?
A2	Saya minat imigresen. Pegawai Imigresen. Tapi Abah cakap, elok masuk jadi cikgu ni, senang sikit kan. Bila kawin, anak-anak tak terabai. Biasalah mak bapak, kan. Masa first time datang sini, rasa macam tak best jugak lah, sebab jauh dengan mak, first time jauh dengan mak, Tapi apply apply, lepas tu dapat. So datang je lah.
Q	Masa lepas STPM, ada apply nak masuk Matrics ke, atau pun..
A2	Ada apply Matrik, tap tak dapat. Saya punya result teruk masa SPM..And then, dapat tawaran STPM, saya rasa berat jugak lah, saya ambik SPM dua kali, masa saya ambik STPM, saya ambik SPM.
Q	So result STP yang bantu you all masuk dalam program ni lah?
A2	Yeah.
Q	You all dalam tahun tiga kan?
A1/A2	Ya, lagi setahun tinggal.
Q	So habis dalam 2007?
A2/A1	2008.
Q	So graduated hujung tahun?
A1/A2	Hujung tahun 2008.
Q	Kalau saya mintak you all fikir balik pasal your skillsdalam ICT dalam penggunaan teknologi khasnya untuk apanama macam penggunaan internet,

	dan juga word, you know powerpoint semua-semua tu.Kalau saya suruh you all nilai diri sendiri dari rate like kosong is tak tau apa-apa, sepuluh ialah macam paling best, expert, how well would you rate yourself?
A1	Powerpoint tu dah....
Q	Bukan apa-apa saja, macam general. Bukan satu software sajelah.Macam penggunaan macam mana nak handle mouse, ikut command dalam PC, you know thing like that, general rules.
A1	Tujuh
Q	Kenapa tujuh?
A1	Sebab ada certain macam software yang tak berapa expert sangat, yang jarang guna tu, dah yang biasa guna tu memang boleh.
Q	ST4 ingat tak masa first time guna PC, masa bila tu?
A1	Tahun empat.
Q	Tahun empat di mana? Di sekolah? Sepuluh tahum la ye?
A1	Yeah
Q	Primary school? So belajar memang formerly dekat sekolah?
A1	Masatu dekat rumah
Q	So ada PC kat rumah?
A1	Ye ada PC kat rumah.
Q	Belajar formally dekat sekolah ada?
A1	Takde, tak pernah masuk kelas computer
	So belajar sendiri sajalah?
	Ye, belajar sendiri saja
Q	Izna?

A2	Setakat ini saya rasa enam.Sebab saya dari perkampungan.Bila daripada perkampungan, saya mula-mula sentuh komputer masa saya tingkatan satu,tapi masa tingkatan satupun sikit-sikit, basically, macam word, lepas tu dah lama sampai tingkatan enam.Tingkatan enam tu pun sentuh-sentuh, tak tahu.Bila sampai sini, satu kejutan lah.Macam apa ni benda-benda power point kan?Kita tak tahu.So macam mula-mula kena tu, macam mana ni, macam mana nak buat benda ni. Bila mintak cadangan cikgu, dia suruh pilih minor dua pilihan,pendidikan khas dengan juga teknologi, so cikgu saya cakap lebih baik ambik teknologi, kamu boleh belajar apa tu.Bila masuk kelas mula-mula tu, apa aku nak belajar ni, tak tahu apapun. So bila mula-mula tekan mouse tu dah rasa macam apa ni...aku buat ni... Tambah-tambah internet memang langsung tak tahu.So dah lama tu kalau pasal macam power point dah expert, word pun dah boleh guna dah, macam Front Page boleh tapi kalau Flash, Macromedia, itu susah sikit...
Q	Tu dah expert punya apa tu...software..
A2	Tapi free web, kitorang ada buat laman web sendiri sekarang, kita orang dah adalah laman web sendiri sekarang, dah boleh buka.
Q	Can you write your address? Do you mind if I see it?
A2/A1	Kitarong buat Nadwi free web..
Q	I see, so siapa yang ajar, ke buat sendiri?
A1	Kitarong explore.Mula-mula ikut arahan. Cuma Dr Saidah bagi macam mana nak buat, alamatnya.Lepas tu kita explore sendiri lah.
Q	Seronoklah buat?
A1	Seronok, seronok dapat buat tu.

A2	Lepas tu muka tu, muka sendirikah kan.Terpampang je.
Q	So macam advertisement URTV la ni?
	Now, dalam katakan lah kalau lagi setahun you all nak keluar ijazah kan? Ni nak ambik berapa banyak kursus ah, education technology punya courses?
A1	Campur ni tujuh.
Q	Campur ni tujuh yang dengan MSTE1 ke?
A	Dengan MSTE1 dua kali.
Q	Lagi kira macam setahun ni la kan nak ambik kursus teknologi ni kan?
A1	Tinggal satu sem lagi yang ada paper lagi, project.
Q	Apa nama, you all rasa setakat ni la, yakin tak nak guna teknologi dalam kelas?
A1/A2	Yakin.
Q	Kenapa yakin, kenapa rasa-rasa yakin?
A1	Setakat rasanya kalau nak buat presenation tentang ABM untuk kanak-kanak ke, kira dah boleh yang buat terbaiklah, kira macam mampu menarik kanak-kanak supaya lebih belajar lagi lah.
Q	Ni Izna?
A2	Sama jugak kan.Seperti kita tau macam kanak-kanak ni kan suka benda yang baru, so bila kita tengok macam something ah, kalau kita buat presentation melalui power point ke, tu kira yang paling simple lah.Saya rasa boleh menarik minat.Tambah-tambah kita tambah animation yang bergerak-gerak sikit, ia akan apa, menarik lah, so kanak-kanak itu akan, terus tumpu tau, macam tapi kita jangan buat selalu, kita buat lah seminggu sekali supaya dia rasa tak bosan kan.
Q	You all dalam programme ni ada dia ajar macam cara nak buat lesson plan menggunakan teknologi?Ada? Boleh ingat tak balik macam mana you all buat lesson plan...design lesson plan?

A1	Selalunya, kitaorang punya lesson plan taip dalam table macam tu jelah.
Q	Tak, tak de yang macam you know sebelum kita buat rancangan tu kan, kan kita kena pikir dulu apa yang sebenarnya kita nak ajar, sumber teknology mana yang kita nak pakai, you know, benda-benda macam tu lah.
A2	Ada.
Q	Cuba cerita kat saya macam you all buat lesson plan tu?
A2	Ok, mula-mula, kita fikir dululah apa topik yang sub topik dia dulu, macam certain kalau kita nak ajar, contoh macam kita nak ajar animal kan, kita perlukan intro dia dulukan.So macam intro seboleh-bolehnya kita guna, masa itu lah, untuk power point tu, and then yang lain itu kita boleh cerita, kemudian yang akhir kita boleh tunjuk balik lah power point tu.Supaya, kanak-kanak mula-mula, dah cikgu cerita panjang-panjang panjang, dah bosan kan.So first tunjuk yang tu supaya dia tertarik dulu and then bila dia rasa dia dah tertarik tu, baru kita cerita sikit-sikit.Tapi, sambil tu kita buatlah, tunjuklah.
Q	So that means, teknologi untuk bahan untuk menarik minat ke?
A1	Yeah, bahan untuk menarik minat.Supaya dia interested lah kepada subjek yang kita nak ajar.
Q	Do you think we need to use the technology throughout the lesson ataupun cuma pada bahagian pertama kelas tu untuk menarik minat sahaja?.
A1	Depends pada cikgu tu.Kalau macam dia nak guna power point, teknologi untuk set induksi, dia boleh guna untuk sebagai set induksi je.Kalau dia nak guna untuk sebagai pengajaran, dia boleh guna untuk part pengajaran, tapi set induksi macam dia guna lain lah... something lah...
Q	Kalau katakan lah, kita nak buat guna teknologi untuk pengajaran, macam mana kita boleh gunakan dengan efective kalau you all boleh pikir balik, you know, yang projek lama-lama yang dah buat dengan pensyarah?

A2	Kitaorang buat melalui game jugak ah. Ok power point tu, melalui power point tu kita boleh bagi kanak-kanak explore sendiri . Kita buat macam satu, macam selalu kami buat lah, mula-mula introduction, kita cerita sikit and then yang last tu kita bagi dia buat latihan maknanya di sini contohnya macam latihan dia macam kata kita tunjuk buah epal, and then di sini di bawah ni kita sebut epal dan juga strawberi, and then, bila dia tekan kalau dia kata epal, bila dia tekan, yang epal ni akan link kepada jawapan anda betul. So kira kalau salah, dia terpaksa buat balik dan di situ kita gunakan song, kita guna suara.So maknanya dia boleh, orang kata, kanak-kanak tu faham, lepas tu dia boleh buat pembetulan walaupun apa powerpoint tak lah sehebat benda lain.
Q	Ok, now, kalau saya nak bina satu lesson ya, again menggunakan teknologi untuk yang set pengajaran yang utama ya, macam mana kita boleh gunakan supaya teknologi tu boleh mencambahkan macam idea-idea creative, you know, dalam pelajar tadi?Instead of just tekan identify kata ni epal, ni strawberi, faham tak?
A1	Macam kita tanya soalan sampingan. Contohnya macam, kita tunjuk just ok pasal buah. Kita tanya kat dia macam apa nama ni macam apa rupa bentuk buah tu ke , rasa dia, yang apa yang tak de dalam keterangan tu la.
A2	Ataupun kita boleh bawak bahan maujud. Sambil kita tunjuk power point tu bagi dia rasa.
Q	Bahan apa?
A1	Bahan maujud, bahan tu bahan semulajadi.Buah yang sebenarlah.Supaya dia rasa, apa tu semua.
A2	Aupaya bila kita tunjuk power point tu, benda tu ida dah ada depan. Kadang-kadang, kanak-kanak ni kan, kalau macam kami kanak-kanak, benda yang dia nampak dengan gambaran dengan benda yang sebenar kadang-kadang tak sama.Macam kita cakap rabbit, ada dua kan, apa ada telinga dua kan, tapi dia tak tahu macam mana.So bila dia tengok kucing pun dia akan cakap rabbit jugak kan. So sekarang kita bawak benda maujud tu, jangan lah

	bawak ikan, bawak benda, example buah lah kan.So kita tahu kita nak ajar dia benda tu.
Q	Kalau dalam you all punya kelas –kelas sebelum ni kan, dalam teknology pendidikan ni, ada tak dia macam explain apa dia critical thinking dengan creative thinking?
A1	Critical thinking memang kita ambik paper.Ada jugak yang memang explain lah pasal tu...
Q	Macam mana you all integrate critical thinking dalam apatu dalam satu lesson yang macam tadi yang menggunakan teknologi?
A1	Suruh kanak-kanak tu berfikir.
Q	Macam mana tu?
A2	Kalau kita tanya kanak-kanak tu kan. Kanak-kanak tu kan perlu berfikir somethingkan. Makna, kita, contohlah, kita bawak benda tu, kita suruh dia describe apa benda ni. Maknanya dia akan cakap benda ni warna hijau untuk apa, bau dia macam mana, rasa dia macam mana.
	Tapi you dah explained that already for me, kan kita tahu pengetahuan ni banyak level kan, banyak peringkat, kita apa nama perlu macam encourage pelajar untuk move daripada satu tingkat kepada satu tingkat yang lain, seterusnya. So macam mana cara kita boleh menggunakan teknologi untuk push students ini belajar so that dia boleh naik satu peringkat yang lebih tinggi?
A1	Selalunya kalau macam dah ada apa-apa pengajaran tu bila kita bagi latihan ataupun soal jawab dengan pelajar, so bila pelajar tu dapat jawab, maknanya dia boleh aplikasikan apa yang kita ajar tu dalam diri dia, so daripada dia peringkat pengetahuan dia akan naik ke peringkat seterusnya, macam tu lah.
Q	So ada pernah buat tak dalam lesson you all, macam lesson plan punya assignment?

A1	Adalah.
Q	Bagi contoh boleh?
A1	Contoh macam mana?
Q	Macam mana you cakap tadi lah yang macam you push daripada peringkat pengetahuan kepada peringkat apa pemahaman kan, lepas tu peringkat apa lagi, lepas tu ?
A1	Aplikasi.
Q	Katakan lah untuk aplikasi, macam dia mana dia nak tercapai?
A1	Macam contohnya peringkat pemahaman, hanya peringkat pengetahuan guru yang beri keterangan kepada pelajar kan. So dia terangkan pasal, contohnya, tajuk dia pasal buah, so dia terangkan buah ada buah local fruit apa semua tu kan, ada imported, lepas tu bila seterusnya macam untuk aktiviti bersama pelajar, guru boleh buat soal jawab pulak dengan pelajar tu.Soal jawab untuk melihat sejauh mana kefahaman dia terhadap pengajaran kita lah, daripada selepas soal jawab tu mungkin guru itu boleh bagi latihan tambahan pulak, untuk dia boleh aplikasi tak apa yang dia dah tahu.
Q	Contoh? Macam mana kita nak aplikasi, nak suruh dia aplikasikan ilmu tu?
A1	Kalau dia balik kat rumah ke?
Q	Dalam kelas.So kita nak make sure dia tahu nak mengaplikasikan apa yang dia tahu..
A1	Mungkin waktu makan, kita tunjuklah benda tu macam kan, dia boleh tahu macam perbezaan rasa sebab waktu makan dia tahu yang ada rasa manis, rasa masam, makna tu dia dah boleh aplikasikan apa yang kita dah terangkan tu dalam kehidupan dia..
A2	Kalau saya berpendapat sama jugak dengan ST4. Macam something budak-budak ni dia tak tahu bila kita cakap pasal aplikasi, betul tak? So bila something yang dia pernah buat so and then dia buat lagi makna dia

	mengaplikasikan benda tu. Macam, contohnya macam ST4 cakap makan tadi, makan dia dapat rasa benda, so bila dia dapat rasa dia akan cakap balik, eh benda ni macam pernah rasa so dia macam aplikasi apa yang cikgu dia ajar tadi dengan apa yang dia buat sekarang.
Q	Ok, you all, tadi cakap ST4 tahu menggunakan computer dalam umur sepuluh tahun ya.Izna kata masa tahun kat sini ya, basically di sinilah, baru-baru nak belajar betul-betul kira ye kan.Budak-budak kita sekarang, especially yang macam duduk dekat KL nilah, keluar-keluar dalam perut emak dia pun dah tahu computer.Macam mana kalau you all... what do you think about apa nama penggunaan teknologi untuk mengajar budak-budak macam ni?
A1	Cikgu tu kena expert lagi lah, tahu lebih daripada, sebab sekarang ni, kanak-kanak ni lebih advanced la daripada kita.
Q	Apa rasanya yang persediaan yang you all perlu mungkin untuk ...
A2	Kita perlu buat persediaan sebelum tu lah, kita perlu tengok dulu, macam mana level kanak-kanak tu, sebelum kita nak masuk mengajar. Kalau contohnya kalau practical, kat KL kita dah tahulah, mesti budak-budak ni mesti fluent dalam pelbagai aspek.Kita mesti tingkatkan lagi kita punya ni. Macam kanak-kanak, kadang-kadang apa macam kanak-kanak kampung, WORD pun tak tahu apa semua tak tahu kan, so bila datang sini, kanak-kanak itu akan tanya.Sebab dia benda dia dah tahu, dia nak tahu benda yang dia tak tahu.So bila benda yang tak tahu, maknanya cikgu kena prepare betul-betullah sebelum nak ni kan, masukkan.Lepas tu kalau nak gunakan teknologi sebagai apa pengajaran, guru tu terpaksa, buat something yang menarik yang budak tu tak pernah tengok.Kanak-kanak tu tak pernak tengok supaya dia akan tertarik, kalau tidak alah, aku kat rumah pun dah boleh tengok kan.So macam, benda tu, tak akan menarik, so macam cikgu pun ah kalau macam ni akupun sama level je dengan budak-budak ni kan, so daripada cikgu tu sendiri dia kena tingkatkan dia punya, orang kata, pengetahuan, cara kemahiran dia.
Q	Kemahiran dalam apa, dalam IT ke?

A2	Dalam IT atau sama ada dalam semua aspeklah, supaya kanak-kanak tu tak bosan dan juga tak memandang rendah kan.Setengah kita tahu cikgu ni daripada kampung kan so kami sendiri pun terpaksa explore ni kan sebab pensyarah pun jarang suruh bagi bab macam ni kan, so banyak explore sendirilah.So bila kanak-kanak pun sendiri pun kita tahu suka explore.
Q	Kalau macam assignment you all selalunya macam mana lecturer bagi kat you all?
A1	Macam dia terangkan basic dia, lepas tu kitaorang explore sendiri lah untuk sampingan tu. Sebabnya nak terangkan semua tak cukuplah masa, seminggu tiga jam je.
A2	Lagipun kadang-kadang kita sendiri yang student ni pun bosan kan, kadang-kadang kan sepuluh minit je boleh dengar betul-betul.Lepas tu, sat lagi... alah..dah tak de kan. So lebih baik dia bagi dengan cara explore kemudian dia tetapkan bila dia nak benda-benda ni supaya tak ambik mudah lah.Supaya macam MSTE1 ni dia tetapkan yang "ok saya nak minggu ni, macam ni".So kita kena explore sendiri cari sendirilah apa bahan dia and then baru kita terang kat dia.So bila salah dia akan betulkan, macam tu lah.
Q	Do you masa buat assignment kan untuk kursus ni, teknologi pendidikan ni, do you know apa range ataupun expectation pensyarah, katakan untuk dapatkan A, untuk dapatkan B, untuk dapatkan C whatever lah kan ataupun fail.Ada idea tak masa kita dapat tugasan tu kan level mana yang pensyarah nak apa dalam pemahaman pensyarah untuk dapatkan A katakan lah and apa would be considered as a failure.
A1	Kadang-kadang kalau sesetengah pensyarah tu, dia beritahulah dia nak yang macam ni, macam ni.So kita kena buatlah, ikut apa yang dia nak supaya boleh dapat A la.
A2	Certain pensyarah pulak, kita kena tanya dia.Dia nak macam mana, kalau tak boleh tanya tu kan, kita pergi jumpa dia, kita tanya dia macam mana nak

	ni kan.Kadang-kadang, kita dah rasa benda tu ok kan bagi kita kan, tapi pensyarah tak nak kan, so kita rasa dah siap tu, kalau boleh kita tanya dia dulu.Kalau dia kata ok then kira boleh terima, boleh accept hah tak pe, kadang-kadang kita rasa kita macam boleh dapat A tapi kadang-kadang kita boleh fail kan sebab kita tak tahu apa dia nak.Kadang-kadang kita kena tahu apa kehendak pensyarah, mungkin dia nak benda tu expect kita boleh buat tinggi daripada apa yang dijangka.
Q	Kalau macam di sekolah nanti, macam mana you all rasa nak sampaikan kepada pelajar you all yang apa yang maksudnya pelajar tu like mencapai expectation you as a teacher?
A1	Terang kat dia ni la, apa sebenarnya yang kita nak dia buat sesuatu yang contohnya..
Q	What is your measure of success? Basically that's what I want to know.
A2	Kita cakap dan juga tunjuk macam mana, lepas tu macam kalau tak paham tanya supaya dia tahu tahap yang kita nak daripada dia.Makna, kalau....
A1	Kalau dia buat salahpun suruh dia tunjuk semula kepada kita supaya kita boleh betul apa yang salah dan kita tak agak, maknanya student itu tahu lah apa yang sebenarnya cikgu itu nak.Kalau kita tak beritahu, macam mana pelajar itu nak tahu, tiba-tiba fail je.
Q	Ya, di pendidikan awal kanak-kanak apa nama, selalunya what is the yang macam kita selalu gunakan untuk define dia punya pencapaian?
A1	Melalui pemerhatian.
Q	Ok...and... Lagi?
A1	Senarai semak, lepas tu buat portfolio untuk dia, kira daripada portfolio itu kita tahulah, record-record dia tu apa semua ah, dalam portfolio itu lah semua, maknanya kita tengok satu perkembangan, peningkatan dia macam mana. So daripada situ, mak bapak tak boleh nak expect kita nak marah kita apa ke semua kan sebab kita dah tunjuk kan ni bukti kan dah buat macam ni

	macam ni, dia dah mencapai apa yang saya nak, semua ibu bapa pun macam tu kan nak something yang orang kata hantar anak dia ke sekolah tujuannya nak meningkatkan anak dia punya pengetahuan.So kanak-kanak tak sama dengan budak-budak sekolah rendah apa semua kan so kita gunakan senarai semak ataupun untuk tengok dia punya kecerdasan.
Q	Satu lagi saya nak tanya pasal teori Constructivism. Ingat lagi tak, ada belajar kan, dalam teori pembelajaran?
A1	Teori Constructivism itu dia bergantung kepada...guru yang lebih apa guru...
A2	guru yang memberi maklumat
Q	No
A2	Dia mengexplore saya rasa, kanak-kanak explore diri sendiri untuk mendapatkan sesuatu, maknanya (A1: guru sebagai facilitator kepada kanak-kanak tu untuk memperolehi maklumat lah) sebab mula-mula sebab kita kena expect yang pelajar itu tahu pengetahuan dia dah ada, Cuma kita menambahkan lagi dia punya pengetahuan. Maknanya kita bagi lagi kemantapan untuk dia berfikir, cara dia buat sesuatu, sebab kadang-kadang bagi kanak-kanak sendiri pun kita dah tahu dia datang ke sekolah bukan dengan tangan kosong. Mesti something yang ada dalam tangan dia dan kita cuma nak dan perlu perkembangkan apa yang ada. Kadang-kadang yang salah kita betulkan.
Q	Kalau saya nak boleh suruh macam Syazana dulu, nak describe apa Constructivism kepada Syazana? What do you understand about Constructivism?
A1	Kanak-kanak tu dah tahu, dah ada pengetahuan sedia ada, guru jangan anggap yang kanak-kanak tu pemikiran kanak-kanak kosong bila dia ke sekolah.Guru perlu membimbing dia untruk menambahkan lagi pengetahuan yang sedia ada.
Q	Ok.
A2	Kalau bagi saya, macam Syazana cakap dia tak datang dengan tangan

	kosong, so sebagai guru kita jangan push dia, kita biar dia explore sendiri, kalau ada salah baru kita betulkan dia supaya dia tahu, dia belajar daripada kesilapan diri dia sendiri, kita just betulkan sahaja dan dari situ makna dia, dia punya pemikiran kanak-kanak ni dia akan berkembang sendiri. Lepas tu kadang-kadang macam...contohlah kanak-kanak kan, so dia nak satu something yang different, yang baru.Dia tahu benda ni, so dia nak lagi benda ni supaya, lebih kembang lagi, so macam apa teori Constructivism, ni kira baguslah sebab kita tak anggap pelajar tu tangan kosong.
Q	You all dalam kursus teknologi pendidikan ni ada tak di mention ataupun di present to you, tentang kaitan konstruktivisma dalam penggunaan teknologi?
A1	Ada
Q	Macam mana ia digunakan dalam teknologi, rasa-rasanya?
A2	Dia explore jugak kan?
A1	Mungkin bagi satu game ke atau satu courseware untuk kanak-kanak tu supaya kanak-kanak tu boleh explore diri sendiri permainan tu maknanya macam dia dah ada pengetahuan sikit-sikit kan, contoh cikgu dah macam dah terangkan sikit-sikit macam ni, lepas tu bagi dia explore sendiri permainan tu,hah daripada situ maknanya dia akan tambahkan pengetahuan itulah.
Q	You all banyak pakai perkataan explore, can you explain to me what explore means?
A1	Macam kami ok contohnya macam benda macam powerpoint kan, kami terpaksa kaji sendiri, kami terpaksa lakukan sendiri untuk dapatkan sesuatu macam tulah, macam nak dapat, ok macam mana nak bolehkan power point tu, power point yang kita buat tu keluarkan suara. So daripada semua fail apa semua yang ada atas tu, kita kena click satu-satu supaya nak tahu yang ni kita boleh dengar suara ke, ada mike ke. So di situ, kena belajar sendiri.Pensyarah cuma nak ah "benda ni saya nak, so awak semua kena cari benda ni, so awak buat yang terbaik", tapi pensyarah takkan marah kalau kita buat ikut kemampuan kita.So maknanya di situ kita belajar sendiri. Kita

	kena cari sendiri apa-apa, so makna di sini kalau samada kanak-kanak pelajar pun kena banyak belajar sendiri.Kita cuma just cakap je apa yang kita nak.
Q	Apa maksud jadi facilitator?
A1	Macam kalau kanak-kanak tu tak paham, satu arahan ke apa kita boleh bantu dia, tolong terangkanlah.
Q	Macam mana bantu tu?
A1	Terangkan dia apa yang dia tak paham tu, macam tulah, sebab kanak-kanak ni kadang tu dia dah tahu sikit-sikit kan, tengok macam ada something yang dia tak tahu tu, dia akan tanya cikgu, jadi masa itu lah kita akan jadi facilitator kepada kanak-kanak.
Q	Lepas tu?
A2	Macam maksud "facilitator", kanak-kanak ni macam kanak-kanak ah, macam kanak-kanak pelajar pun dia macam Syazana cakap tadi, dia tahu benda tu kan, kadang-kadang kalau kita jadi cikgu, kalau jadi cikgu, kita akan megarahkan, kalau kita mengarahkan maknanya kita memaksa kanak-kanak tu buat something yang dia tak suka, betul.So bila kita, ok kita, contoh kita bagi satu kanak ke, pelajar, kita bagi satu topik, topik itu memang perlu maklumat-maklumat macam ni. Kita jangan push, saya nak benda ni macam ni- macam ni.Tapi, bila dia tanya dulu soalan dia supaya dia orang tahu apa yang dia orang nak, bukan cikgu nak, cikgu cuma orang kata kelas-kelas apa yang dia orang nak, tujuan ke, objective ke, lepas tu, ahhh, bila dia orang, student ataupun kanak-kanak ni cari, kanak-kanak itu akan tanya dulu, kalau cikgu kata ok, yang ni betul.
Q	Going back one step ya, rasanya dalam kursus pendidikan teknologinikan, you all ada diajar macam mana nak menggunakan teknologi very specifically untuk address macam content dan juga pedagogy? Faham tak maksud soalan-soalan saya.

	Macam kan kita sebagai guru kalau kita nak, nikan untuk mengajar kita perlu ada apanama pengetahuan dalam menggunakan pedagogi, tahu?
A1	Kaedah dia nilah?
Q	Ya, kaedah pengajaran.Ok, apanama, semualah ilmu tentang kaedah pengajaran, teori pembelajaran, teori pengajaran, apa ni, semualah tu.That is pedagogy ya.Now katakanlah macam kita mengajar matematik, untuk apa your students, kita perlu tahu kan bukan sahaja matematik, tapi kita perlu tahu macam mana nak ajar matematik.You all tahukan some teachers dia masuk dalam kelas je tak tahu mengajar, dia baca saja ataupun dia tulis aje dekat boardkan, now ok, kita ingin melahirkan guru-guru yang pandai menggunakan pedagogi yang betul, untuk mengajar subject yang sepatutnya dia orang ajarlah.Ok.Now dengan penggunaan teknologi dalam kelas, satu lagi issue baru yang masuklah because... yang timbul sebab kiranya bukan saja cikgu ni perlu tahu matematik tadi, dia perlu tahu macam mana nak ajar matematik,sekarang dia kena tahu macam mana ajar matematik guna teknologi yang betul, dengan at the same time kena tahu pedagogi yang cukup untuk menyampaikan dia punya pengajaran dengan effective.
Q	You all rasa-rasa dalam kursus yang you all dah ambik ni, adakah cukup untuk train you all untuk mengajar macam tu? Rasa-rasanya...?
A1	Rasa-rasa setakat ni cukup (A2:sikit-sikit), tapi belum maknanya kena tambah lagilah pengetahuan tu.
Q	Kenapa tadi Izna kata sikit-sikit, apa yang sikit-sikit tu?
A2	Sebab, macam tak semua orang tahu pasal pedagogi dengan juga diaplikasikan dalam teknologi pengajaran. Kalau bagi saya, saya tahu macam mana guna teknologi tapi pedagogi tak semestinya saya tahukan.So disini, saya perlu seiring, betul.Seiring, dua-dua saya perlu tahu. Disini saya kena gunakan pembacaan yang banyak macam mana nak mengajar.Kita bukan saja nak ajar kanak-kanak tahu tolak, tambah,bahagi, tapi kita nak tahu macam mana dia akan aplikasikan tolak tambah bahagi ni dalam kehidupan dia. So, disini, kita kena guna kaedah macam, gunakan something macam for example kanak-kanak dia tak tahu tau macam tolak, tambah,

	bahagi dia tak tahu apa itu semuakan, so maknanya kita kena guna bahan yang something yang boleh buat dia paham, ah, benda ni tolak, takde, so kita macam kita guna pen ke, bahan maujud kan, supaya dia nampak benda tu.dari situ huh, barulah kanak-kanak itu boleh aplikasi.Kalu menggunakan teknologi maknanya pengajaran ataupun pedagogi ni perlu seiringlah.So disamping gunakan, pengajaran yang betul, teknologi tu dimasukkan sekali supaya dia lebih kembang.Bila macam kita gunakan bahan-bahan maujud, tapi kita gunakan teknologi jugak.So di situ kita boleh tunjuk dan cerita maknanya benda yang sama masuk. So bila nak dia keluar dia akan faham benda tu sikit-sikit walaupun tak banyak.
Q	Syazana?
A1	Macam tu kira jugaklah.Kira macam...
Q	Kenapa tadi Zana kata cukup?
A1	Eh, tak cukup jugaklah. Kira kena, tambah lagi lah ilmu yang ada sebab dekat sini pun macam terhad jugaklah,belajarkan, sepanjang masa kita ada kuliah apa-apa semua, jadi kena....
Q	Dalam coverage kuliah ni, yang you all dah attend apa ni semuakan, rasa-rasa enough tak you know yang dalam presentation ni, untuk mengaplikasikan teknologi dengan efective sekali, dengan you know, considering pedagogi dengan content tadi, yang, for example matematik?
A2	Bagi saya tak cukup.Kita kena, sebab kita tak berada di situasi yang sebetulnya.Macam kami tak pernah belajar lagilah, kita belajar teori tak sama seperti praktikal.Kalau kita pergi sekolah, baru tahulah samada, cukup ataupun tak apa yang kita dah belajar.Jadi kita boleh perkembangkan. Ok, teori ni aku dah belajar, macam mana aku nak aplikasikan ini.So kalau benda ni teori tak boleh nak guna, so kita terpaksa cari kaedah-kaedah yang lain, teori yang lain pulak.So maknanya, bagi saya tak cukuplah, sebab kami tak alami lagi benda ni di luar.Just belajar teori, ok, pedagogi, apa semua.
Q	Assignment tak tolong?

A2	Assignment saya rasa tak banyak tolong.
Q	Zana?
A1	Sebab ya lah belajar teori sajakan walaupun ada assignment tapi still depend kepada teori jugaklah.Kita tak alami sendiri macam mana.
A2	Macam kawan-kawan cakap kan, korang sekarang boleh cakap teori-teori, bila kau orang dekat sekolah contohnya sekolah untuk tadika, kanak-kanak kan, tak sama dengan teori dengan ni, kita kena gunakan idea yang kita ada sendiri, kaedah pengajaran kita, tapi kita masih mengikut apa, teori-teori yang kita belajar tapi cara aplikasi kita lain.Ah, macam tu jugak, kita nak ni kan tapi memang bagi saya memang tak cukup lagilah setakat ni.
Q	My final question, rasa-rasanya bila dah you all habis daripada program ni, dan insyaAllah keluar nanti graduate dah dapat kerja semua, apa rasa-rasanya issue yang you all akan jumpa di sekolah nanti, ya, berkaitan dengan penggunaan teknologilah?
A1	Teknologi dalam pengajaran? Macam guru kena tahulah macam mana nak gunakan aplikasikan teknologi dalam pengajaran dia supaya pengajaran dia jadi lebih berkesan.Sebab sekarang ni, dunia dah ke arah teknologi kan, penggunaan teknologi, jadi cikgu-cikgu ni kena macam, eh.. memang perlu ambik tahu tentang teknologi, jangan masih di tahap lamalah, memang yang tu kita boleh guna OHP untuk sebagai pengajarankan, tapi macam teknologi terkinipun kita kena perlu guna juga.
A2	Masalah kan?
Q	Ya masalah.Issue lah.
A2	Isue yang akan timbul selalunya. Selalunya, issue yang akan timbul cikgulah sebab kalau cikgu ni macam pelajar macam kadang-kadang sepeti puan cakap tadi kan, kadang-kadang pelajar ni lebih pandai daripada cikgu.So cikgu masalah yang perlu dihadapi oleh cikgu, cikgu kena expert lagi daripada pelajar tu.So di sini cikgu kena tambahkan lagi pengetahuan dia

	samada bakal guru ataupun guru ni.Kadang-kadang, contohnya kalau, macam guru KPLI sendiri kan, kita tengok pengetahuan dia kurang tapi dia terpaksa mengajar satu-satu benda tu kan, contohnya dalam bidang lain, tiba-tiba masuk dalam bidang ni, so dia kena benda yang baru, kita kena tumpu. Kalau dalam teknologi pulak cikgu ni first memang teknologi ni, kalau cikgulah, dia cikgu yang cetek pemikiran dalam teknologi kita boleh perkembangkan supaya besok kanak-kanak tak bosan sebab macam Zana cakap, kita kearah kedepankan, teknologi kan somethingsasi semua, cikgu di takat ni orang kata pelajar di tingkat so pelajar itu akan pandang rendah aje, so tak de apa so macam mana kita nak didik anak yang, anak muridkan yang supaya dia jadi pandai lepas tu hormat kita, hrmat emak bapakkan, ni macam memang tahap kita kena kembangkanlah.
A1	Ni macam cikgu lama pun sepatutnya perlu diberi kursus supaya dia orang advancelah penggunaan teknologinilah supaya pelajar tu tidak akan pandang rendah kepada cikgu. Sebab pelajar sekarang ni, tahu mengalahkan cikgu.
A2	Tapi kita sebagai seorang guru, pedagogi, teori pedagogi dengan teknologi perlu seiring supaya kita tak kekok untuk ni lah kan, untuk menjalani latihan ataupun mengajar kanak-kanak ke pelajar supaya kita tak berada di takok yang lama.
Q	Jadi sentiasa kena perlu...up to date lah. Ok itu saja.

APPENDIX J Coding/Key concepts used in Data Analysis

Teacher Educator Interviews

Academic Route

Constructivism - How they use in course

Constructivism - What they understand

Constructivist Elements - Use of Jargons

EdTech courses taught

Experience in EdTech field

First ICT experience

ICT Self-rate

Introduction to Self

Justification for ICT Self-rate

Motivation to teach EdTech

Perception about TPCK in own EdTech course

Perception: Abt Teaching of EdTech

Perception: EdTech use in general

Perception: Success in student learning Edtech

Perception: Teacher Knowledge

Perception: Teacher Role in ICT use

Tackling comprehension issues with EdTech

Training students in Lesson Planning

Understanding: Content Knowledge

Understanding: Overlapping Knowledge Types

Understanding: Pedagogy Knowledge

Understanding: Technology Knowledge

Use of external resources

Student Teacher Interviews

Academic route

Confidence to use EdTech in class

Constructivism - What they understand

Constructivism: Training to use it

Constructivist Elements _CriticalCreativeThkg

Ed Tech courses taken

Experience in field of study

First ICT experience

ICT Self-Rate

Introduction -Self

Justification for ICT Self-Rate

Motivation to study

Perception about Teacher role in ICT use

Perception abt TPCK training in EdTech courses

Perception abt Training of EdTech in courses

Perception of EdTech use

Perception of Success in Learning EdTech course

PK: Pedagogical Knowledge

Tackling comprehension issues with EdTech

Training in Lesson Planning

Understanding: Content Knowledge

Understanding: Overlapping Knowledge Types

Understanding: Pedagogy Knowledge

Understanding: Technology Knowledge

APPENDIX K Assignment Descriptors

These documents were collected for Case Study 3 at University Z.

ASSIGNMENT 1 (20%)

You will spend the next four weeks learning how to use Smartboard or Interactive Whiteboard (IWB) in teaching and learning. You will explore ways to integrate this technology in your subject.

You will work in a group of 4 persons. Form your team and give it a name.

The steps below will guide you in your learning of the new technology:

What to do	How to do
1. Read the article The Use of Interactive Whiteboards in Schools by Tolley. Pay close attention to the 12 teaching techniques.	Retrieve the article from the file folder in the yahoo group DipEd_2007 Readings. The file name is *IWB Tolley.rtf*
2. Attend the class and the lab sessions.	Make sure you are not late. You will meet the lecturer. The lecturer will guide you on how to use the IWB. The lecturer will show examples of materials developed by teachers for use with the Smartboard.
3. Your assignment	Practice to use the IWB. You will get another two opportunities to master the skill.
4. Identify the topics from your teaching method (English or	Bring content (syllabus) from books or internet suitable for the Primary level. Select a specific

Mathematics) that you would like to prepare for a specific audience of specific learning styles.	topic that you would like to work with. Remember not all topics are suitable for use with IWB.
5. Examine samples of IWB materials with a purpose to adopt, adapt and innovate.	The lecturer will show you samples developed by other teachers. You may also retrieve the samples from WWW. When you examine the samples keep in mind the following: 1. How do I adopt this material for my teaching? 2. How do I adapt (modify) this material to meet the needs of my students and their learning styles? 3. I would like to be more innovative in my teaching, and I would like to use this material. How do I create my own lessons or materials based on the sample and make it more creative and innovative? 4. Making it creative or more innovative may involve redeveloping your own material and redesigning your lesson activities which you will do in #5. 5. What model will I adopt in my lesson plan?
▪ Develop 4 new materials for teaching (the materials may contain at least 5 screens each): • 2 for English • 2 for Mathematics	Your design must take into consideration the following: • Target audience: • Topic: • Pre-requisite knowledge: • IWB activity: o Introduction or activation of learning o Delivery or demonstration of

	content o Practice or exercise o Integration of learning • Your rationale for the activity must be based on what you know about theories of learning, and how learners learn. You must be able to relate the activity to how students learn. Please make sure that you read on the theories of learning and how learners learn.
6. Don't forget to record the reflection of your learning in your blog.	Weekly report of what you have learned and what you have questioned.

ASSIGNMENT 2 (20%)

WEB BLOGGING

In this assignment you are to record your lesson learned every week on a blog.

1. Set up your blog on blogspot.com the first day of class. You will be guided to do this.

2. Write your weekly report on the blog. We will be checking your progress every week.

3. Your blog entry must show your ability to reflect on the following:

   a) Today I learn

   b) Today I question

   c) Your initiative to find more information on the topics discussed in the class

4. You will have to post at least 5 blogs till the end of the semester.

5. Your blog postings will be assessed based on the following:

   a) Minimum number of postings (5) = 5%

   b) Content = 10%

   c) Presentation and creativity = 5%

APPENDIX L Programme Structure and Content for Education – Malaysian Qualification Agency's Standard for All Education Programmes in Malaysia

Structure	Content
Fundamentals of Education (25%-35%) Selectr from the content listed or integrate to suit needs of various sectors or programme	Philosophy, history and policy of Education Sociology of Education Cognition and Learning Testing, measurement, and evaluation **Educational Technology** including ICT Curriculum & Instructional Design Pedagogy and Andragogy Management of Classroom/Learning Environment Ethics of the Teaching Profession Foundation of Educational Research and Academic Exercise Foundation of Educational Management Guidance and Counselling
Subject Matter and Methodology Generic Skills – integrate with Subject Matter (45% - 65%)	Integrated in the content where relevant Leadership, communication, entrepreneurship, problem-solving, decision-making, creativity,

	information management etc.
Practicum (8% - 10%)	Practicum di various educational setting
Contemporary Issues in Education and Society (4% - 5%)	For example: Social issues, sexuality, globalisation, language issues etc
Talent/Personal Development (Student Teacher) (4% -5%)	Mastery of language, Presentation arts, sports, volunteering etc