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Exploring the influences on university teachers' decisions to integrate technology in teaching

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Abstract

The rapid growth of technologies in modern society has brought significant changes to teaching and learning. In higher education, there is an expectation that university teachers will integrate technologies into their teaching to enhance student learning and study. Technologies in higher education have provided teachers with many choices in how to design and implement their teaching practice. Whilst university teachers can use technologies in varying ways in online and face-to-face environments, little empirical evidence has explored in depth how and why teachers integrate technologies into their teaching. Previous research has identified factors that influence university teachers' technology integration, such as teacher knowledge, self-efficacy and 'technology value' (Benson & Ward, 2013, Chen, Liao, Chang, Hung & Chang, 2019; Khan, 2011; Mishra & Yahya, 2007; Horvitz, Beach, Anderson & Xia, 2015; Robinia & Anderson, 2010; Ajjan & Hartshorne, 2008); however, these studies have mainly examined these factors in isolation. The purpose of this study was to explore university teachers' integration of technology in teaching by investigating the influences of knowledge, self-efficacy and technology value in a single study addressing how and why university teachers integrate technologies in different academic contexts.

A qualitative case study was conducted within one Australian university. Seven university teachers across different academic contexts in Education, Psychology, Information Technologies and Arts were interviewed and observed for one teaching semester. The research was guided by the question: In what ways does a university teacher's TPCK, self-efficacy, and value of technology integration influence their use of technology in their teaching? The theoretical framework underpinning this research drew on three constructs to account for various factors that influence technology integration that have been identified in the literature: Mishra and Koehler's (2006) Technological Pedagogical Content Knowledge (TPCK) Framework, Bandura's (1977) Theory of Self-Efficacy and Eccles et al.'s (1983) Expectancy-Value Theory. The TPCK Framework was used to conceptualise the technological, pedagogical and content knowledge teachers possess and how these forms of knowledge interact to enable the effective integration of technology in teaching. Bandura's Theory of Self-Efficacy framed teachers' levels of self-efficacy when completing specific technology-based tasks. Eccles et al.'s Expectancy-Value Theory helped to account for the value that university teachers place on the use of technology in their teaching.

Data were collected from participants before, during and after one 13-week university semester in Autumn 2015. Each participant and their teaching of a single subject (either undergraduate or postgraduate) was observed. Teacher interviews and observations of teaching were collected and analysed as primary sources of data. These data sources were complemented by subject artefacts and documentation, including subject outlines and assessment rubrics, which were collected by the researcher during artefact analysis of online material. Data analysis was guided by the research question,

and each case was analysed in multiple stages, allowing rich accounts of how university teachers used technologies in their teaching. Cross-case analysis identified themes and patterns that existed in (a) subject design and technology use; (b) teacher knowledge, self-efficacy and technology value; and (c) contextual factors influencing technology integration.

This study found that contextual factors (e.g. institutional factors, course/program factors, subject factors and activity level factors) influenced university teachers' technology integration in teaching. In subjects with a specific focus on technology use, such as graphic design and teaching and learning with technology, teachers embedded technology into the design and delivery of their subjects because technology was required for students to either create products or learn about technology and its affordances. However, the study found varying levels of technology integration, with university teachers focusing more on technology use to either teach content or prepare students for future professional practice.

Through exploring the factors of knowledge, self-efficacy and technology value, analysis revealed that all three factors influenced technology integration in a specific subject instance, and that emerging relationships among these factors existed. Two examples of this relationship included: a university teacher may possess the knowledge and self-efficacy to use technologies in their teaching, but may not value technology integration, for reasons such as the complexity of the subject's content and the characteristics of the student cohort; or a university teacher may value the use of technology to prepare students for future professional practice, but may not possess the knowledge or self-efficacy to realise this goal independently and may seek support to embed technologies into their practice. Therefore, this research has found that all three factors are important for university teachers' technology integration; however, they varied between cases depending on context and interactions that occurred in particular ways within certain environments.

This research provides evidence that can inform future teaching practitioners, university designers and stakeholders. It provides a more comprehensive, holistic view of teachers' technology integration in higher education through drawing on three theoretical constructs in a single study: knowledge, self-efficacy and technology value. The findings of this research have advanced understanding about the contextual factors that enable or constrain technology integration in teaching. A practical implication for universities is that this research provides advice about the types of supports that institutions can provide teachers when integrating technology into their teaching. A practical implication for university teachers is that this research highlights the possibility of TPCK as a metacognitive tool promoting reflection on technology use in teaching. This study has revealed the limitations of a qualitative case-study approach and has highlighted how the small sample size of this research can have an impact on the ability to generalise the findings to other contexts. The findings of this research suggest further avenues and directions that can guide future researchers.

Acknowledgments

I would like to dedicate this thesis to Gina and Carmela Russoniello.

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To my mum (Antoniette), dad (Joseph) and siblings (Carmen, Anthony and Matthew) – thank you for always believing in me and giving me every opportunity to succeed. A special mention to my mother – you have given me the encouragement and belief that I could complete this journey. I will forever be grateful for your endless love and unconditional support.

Certification

I, Amanda-Rita Gigliotti, declare that this thesis submitted in fulfilment of the requirements for the conferral of the degree Doctor of Philosophy, from the University of Wollongong, is wholly my own work unless otherwise referenced or acknowledged. This document has not been submitted for qualifications at any other academic institution.

Amanda-Rita Gigliotti

31st March 2019

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Chapter 1
Introduction to the Study

1.1 Introduction

Universities are rapidly changing to meet the demands of a technological society and the widespread expectations about quality teaching and learning. In higher education, there has been a focus on the integration of technologies into teaching to enhance student learning and study (Goodyear, 2015). Universities have placed effort into the use of various online approaches, such as blended learning and massive open online courses (MOOCs), to allow increased flexibility and access to study, interactions amongst students and a more active student role in learning (Gedik, Kiran & Ozden, 2012; Shand & Glassett, 2018; Sirakaya & Ozdemir, 2018). Higher-education classrooms include technologies such as computers, document readers, lecture-capture technology, interactive whiteboards and projectors that can support teaching and learning and promote collaboration. With universities investing in institutional technologies, there is an expectation that teachers will use technologies innovatively in their practice, even though they may have varying levels of expertise, come from a non-teaching background and have a full workload incorporating teaching, research and governance. However, some university teachers are not adopting these technologies or using them effectively in their teaching (Nicolle & Lou, 2008). Previous research has identified barriers to technology integration, including teacher knowledge, self-efficacy and technology value (e.g. Benson & Ward, 2013; Chen, Liao, Chang, Hung & Chang, 2019; Khan, 2011; Mishra & Yahya, 2007; Horvitz, Beach, Anderson & Xia, 2015; Robinia & Anderson, 2010; Ajjan & Hartshorne, 2008). However, these studies have mainly focused on these three factors in isolation, and no study to date has looked at them together. Thus, further research is needed to provide a more comprehensive understanding of the variations that exist amongst university teachers' technology use.

This study investigated the factors that influence university teachers' technology integration in teaching. Three factors – knowledge, self-efficacy and technology value – were drawn upon in a single study to investigate teachers' technology integration in different academic contexts: Education, Psychology, Information Technologies and Arts. The aim of this study was to gain a more comprehensive understanding of the ways contextual factors enable or constrain technology integration in teaching. An understanding of how all three factors (knowledge, self-efficacy and technology value) influence technology integration can inform the design of future technology-based teaching and learning environments in different academic contexts. Thus, this research focused on using the three theoretical constructs alongside each other to identify some emerging relationships between them and reveal a more comprehensive framework on the decisions university teachers make on technology use in higher education.

This introductory chapter is presented in three sections. The chapter begins by explaining the background of the study, the question that framed the investigation and the research strategy adopted. It then addresses the significance of the study and its limitations, and concludes by defining key terms and presenting an overview of the thesis.

1.2 Background to the study

Teaching in higher education has become increasingly more complex with the introduction of institutional technologies (Goodyear, 2015; Toro & Joshi, 2012). University teachers now have access to, and are expected to use, a range of technologies innovatively in their teaching of discipline-specific subjects to deliver content and prepare students for future professional practice. Research has shown that an array of institutional technologies is available to university teachers to use in their teaching, such as desktop computers, video conferencing equipment, learning management systems and email facilities (Appana, 2008; Jamil & Shah, 2011; John, 2015; Renes & Strange, 2011; Shampa & Kaushalesh, 2018; Tulinayo, Ssentume & Najjuma, 2018; Zhao, Alexander, Perreault, Waldman & Truell, 2009). However, regardless of the availability of these resources, the integration of technology in teaching varies (Adeoye, Oluwole & Blessing, 2013; Ajjan & Hartshorne, 2008).

Empirical research has identified a number of factors that influence university teachers' technology integration, such as teacher knowledge, self-efficacy and technology value (Ajjan & Hartshorne, 2008; Benson & Ward, 2013; Chen, Liao, Chang, Hung & Chang, 2019; Horvitz, Beach, Anderson & Xia, 2015; Koehler, Mishra & Yahya, 2007; Tyahi, 2012). Teacher knowledge has been found to be important when planning for the integration of technology in teaching. Teachers must be able to combine their knowledge of technology, pedagogy and content to ensure that their use of technology aligns with learning outcomes and successfully meets its intended purposes (Mishra & Koehler, 2006). Benson and Ward's (2013) research concluded that university teachers are highly likely to use technology in their teaching without consideration of how pedagogy and content may cause issues for effective technology integration. Training solely focused on technological knowledge is insufficient in allowing teachers to embed technologies effectively in their teaching. Koehler, Mishra and Yahya (2007) reinforce this idea, as their research outlines that content and pedagogy must be considered when planning for technology use. Teacher self-efficacy is important to technology integration, as it provides individuals with the belief that they can successfully complete specific technology-based tasks. In higher education, research has shown that university teachers' perceived levels of self-efficacy have an impact on decisions to adopt and use technologies in teaching (Horvitz, Beach, Anderson & Xia, 2015). Variables influencing university teachers' self-efficacy for technology integration include student learning, online teaching, academic context, gender and teaching satisfaction (Horvitz, Beach, Anderson & Xia, 2015). University teachers must also value the use of technology in their academic context. Research has shown that although some

faculty members can see the benefits of using Web 2.0 technologies to improve student learning, their attitude and perceived behavioural control can have a strong impact on their intentions to use technology in teaching (Ajjan & Hartshorne, 2008; Tyahi, 2012).

Although attention has been paid to exploring the influences of knowledge, self-efficacy and technology value on university teachers' technology integration, the limitations of this research are evident. Limited research has been undertaken on how these factors influence university teachers' technology integration in different academic contexts. Further, no investigation to date has explored knowledge, self-efficacy and technology value in the same study in the context of technology use in higher education or investigated the emerging relationships between these theoretical constructs. Instead, a considerable amount of the research to date has focused on the knowledge and self-efficacy of pre-service teachers undertaking education programs or inservice teachers where quantitative methods were employed, such as surveys and questionnaires (e.g. Jang & Tsai, 2012; Kent & Giles, 2017; Koh, Chai, Hong, & Tsai, 2015; Schmidt et al., 2009). Also, limited research has focused on the value university teachers place on technology in teaching. To address this gap, this study sought to investigate how context shapes university teachers' technology integration. A comprehensive, holistic framework that draws on knowledge, self-efficacy and technology value was used to guide the investigation. Seven real-life case studies of university teachers who each taught a single subject were explored and analysed to see how technologies were integrated across different academic contexts. The use of qualitative methods provided an in-depth examination of participants' perspectives and interpretations of technology use in their teaching. Given that a review of the research has shown that quantitative methods have commonly been used to explore pre-service teacher's knowledge and self-efficacy, this study was exploratory in nature.

1.3 Research question

This study was guided by the following research question:

In what ways does a university teacher's TPCK, self-efficacy, and value of technology integration influence their use of technology in their teaching?

1.4 Research strategy

The investigation of university teachers' technology integration in higher education requires the use of research procedures that can adequately capture the complexity of this practice. Given the exploratory nature of this study, a qualitative research approach was employed. Qualitative techniques are useful for exploring a research topic where little information is available, especially where variables are unknown, context is deemed important and the theoretical foundation requires development (Creswell, 1994; Creswell, 2018). Through using a qualitative research paradigm, the researcher was able to focus on

understanding the perspectives and interpretations of individual university teachers, revealing how their knowledge, self-efficacy and technology value influenced their technology integration in teaching.

This study adopted a case study approach which allowed an in-depth examination of the natural setting (Merriam, 1998; Stake 1995; Yin, 2003; Yin, 2017). By using a case study approach, a researcher can develop an understanding about complex relationships, as well as the participants' experiences within the setting to enable multiple realities to unfold (Cohen, Manion & Morrison, 2000; Lincoln & Guba,1985). A strength of this research strategy is that it addresses the 'how' and 'why' questions within real-life settings; this was of particular interest for this research study (Yin, 1994; Yin, 2003; Yin 2017).

The investigation was set within the context of one Australian university. Data were collected from seven participants before, during and after one 13-week university semester in Autumn 2015. Each participant and their teaching of a single subject (either undergraduate or postgraduate) was observed. Interviews and observations were the primary sources of data collected for this study. Interview data provided insights into university teachers' perceptions about their knowledge, self-efficacy and value in using technology in teaching. Observational data were used to gather information about each participant's technology-based teaching and learning activities, which subsequently provided a stimulus for discussion during the end-of-semester interview. These data sources were complemented by subject artefacts and documentation, including subject outlines and assessment rubrics, which were collected by the researcher during online observations.

Data analysis was undertaken to identify themes and patterns in the data and to draw conclusions to answer the research question (Creswell, 2009). The data were coded according to emerging themes, as well as Mishra and Koehler's (2006) TPCK Framework, Bandura's (1977) Theory of Self-Efficacy and Eccles et al.'s (1983) Expectancy-Value Theory. Cross-case analysis identified themes and patterns that existed in (a) subject design and technology use; (b) teacher knowledge, self-efficacy and technology value; and (c) contextual factors influencing technology integration.

1.5 Significance of the study

This study addresses a significant problem in higher education by exploring the variations that exist amongst university teachers' technology integration in teaching. Technology use in higher education is important when preparing students for future work and life, and has been shown to enhance student learning and study (Gorra & Bhati, 2016; Miniaoui & Kaur, 2014). Literature supports the use of educational technologies to assist students in developing professional knowledge, skills and competencies (Coyne, Frommolt, Rands, Kain & Mitchell, 2018; Dodds, Heslop & Meredith, 2018). For example, Dodds, Heslop and Meredith (2018) argue that social-work education should include online simulations to assist students in developing professional competence and skills required by practitioners

in their field. They propose that the use of simulations in social-work education can minimise the gap between knowledge and skills. Technology use in higher education can also enhance student learning. Research has shown that technology provides students with access to information online (Gorra & Bhati, 2016), allows for flexibility in learning (Shand & Glassett, 2018) and enables interactions amongst students and teacher (Miniaoui & Kaur, 2014). Therefore, there is a need to understand how and why a teacher integrates technology into their teaching, as the reasons for this are not yet well understood. Work has been undertaken in this area (e.g. Ajjan & Hartshorne, 2008; Benson & Ward, 2013; Horvitz, Beach, Anderson & Xia, 2015; Koehler, Mishra & Yahya, 2007), but it does not provide a comprehensive, holistic understanding of the problem; therefore, further investigation is required.

This research study advances knowledge in the field by providing a comprehensive, holistic view of university teachers' technology integration by drawing on three theoretical constructs in a single study for the first time: knowledge, self-efficacy and technology value. To date, there is no research investigating university teachers' technology integration in teaching using Mishra and Koehler's (2006) TPCK Framework, Bandura's (1977) Theory of Self-Efficacy and Eccles et al.'s (1983) Expectancy-Value Theory. Drawing upon these three theoretical constructs can improve understanding about the contextual factors that enable or constrain technology integration in teaching. A practical implication for universities is that this research provides advice about the types of supports that can assist university teachers' technology integration in teaching. An implication for theory is that this study has provided insight into the holistic nature of technology integration when teaching in higher education. Avenues and directions for future research are suggested in the final chapter of this thesis.

1.6 Limitations of the study

The limitations of this study are as follows:

- The researcher was the main instrument for data collection. Given that qualitative methods were employed for this study, this raises the issue of subjectivity in data collection, as the evidence and conclusions of the research are based on a single perspective (Bogdan & Biklen, 1998; Flick, 1998). Whilst this is seen as a flaw of qualitative approaches, the researcher identified how her subjectivities influenced the inquiry and its outcomes by providing details about the strategies and protocols used during the study.
- This investigation was undertaken at a single Australian university, involving seven participants. Therefore, the scope of the study was limited, as a small sample of participants was studied, affecting the ability to generalise findings to other contexts. The findings of this study acknowledge that the research context is unique, and that this influences the transferability of conclusions and implications to other settings.

1.7 Definition of terms

University teacher: An individual who is employed to teach students at a higher-education institution.

Academic discipline: A branch of knowledge that is taught and researched in higher education.

Educational technology: 'Educational technology is the study and ethical practice of facilitating learning and improving performance by creating, using and managing appropriate technological processes and resources' (Richey, Silber, & Ely, 2008, p. 24).

Moodle: A learning management system, the purpose of which is 'to provide educators, administrators and learners with a single robust, secure and integrated system to create personalised learning environments' (Moodle, 2018).

Technological knowledge: An understanding about standard forms of technology and more-advanced forms and the skills involved in using different technologies (Mishra & Koehler, 2006).

Pedagogical knowledge: The practice of teaching and learning. This form of knowledge focuses on how to design learning environments for student learning and assessment. A deep understanding of pedagogical knowledge revolves around knowledge construction and the application of learning theories to practice (Mishra & Koehler, 2006).

Content knowledge: The specific subject matter of a discipline area (Mishra & Koehler, 2006).

Technological, pedagogical, content knowledge (TPCK): The TPCK Model is a conceptual framework that addresses teachers' knowledge development and acknowledges that successful technology integration includes the complex interplay between technology, pedagogy and content (Mishra & Koehler, 2006).

Context: Mishra and Koehler (2006) acknowledged the influence of context on teachers' TPACK. They described context in the TPCK Framework as 'there is no single technological solution that applies for every teacher, every course, or every view of teaching. Quality teaching requires developing a nuanced understanding of the complex relationships between technology, content, and pedagogy, and using this understanding to develop appropriate, context-specific strategies and representations (Mishra & Koehler, 2006, p. 1029).

Self-efficacy: An individual's belief in their ability to perform and achieve specific tasks in a certain domain or context (Bandura, 1977).

Value: An individual's motivation and reasoning behind why they would undertake a certain task (Eccles et al., 1983).

Technology integration: Technology integration focuses on the use of technological tools and resources in various content areas to enhance teaching and learning. Technology integration should be based on the curriculum and thus, the curriculum must drive technology use in educational environments.

Blended learning: An educational approach that combines online delivery and face-to-face teaching.

Massive open online courses (MOOCs): 'MOOCs offer open, online learning at a massive scale' (Hood, Littlejohn & Milligan, 2015, p. 2). These courses function as non-formal learning environments in which students decide how, when and in what ways they will engage with content. Generally, students will have access to video-recorded lectures, automated assessments and online discussion forums. Learners can interact with one another, and the instructor is not involved in online interactions.

1.8 Structure of the thesis

This thesis consists of six chapters. Chapter 1 provides an overview of the investigation, including detail about the background and significance of the study and the research strategy employed to guide the investigation. The remaining chapters elaborate on the issues presented in Chapter 1. Chapter 2 presents a review of the relevant literature associated with current thinking on university teachers' technology integration in higher education, with a specific focus on the influences of knowledge, self-efficacy and technology value on teachers' technology use in teaching. Chapter 3 describes the methodology of the research, including participants, research design, data collection and data analysis. The results of the investigation are presented over two chapters. Chapter 4 presents the study's results and a preliminary discussion of findings. Chapter 5 provides a cross-case analysis to identify similarities and differences between cases. The final chapter, Chapter 6, presents the findings in response to the research question and addresses limitations and implications for future practice. Areas for future research are also suggested.

1.9 Chapter summary

Chapter 1 has provided an introduction and rationale for the investigation. It outlined the research question, research strategy and significance of the research. This chapter also addresses the limitations of the study and relevant key terms. Chapter 1 concludes with the structure of the thesis.

Chapter 2
Literature Review

2.1 Introduction

In higher education, technology use has become widespread and there is an expectation that university teachers will integrate technologies into their teaching (Goodyear, 2015; Toro & Joshi, 2012). Technologies have provided more choice in the way teachers design and implement teaching and learning experiences. The use of online educational environments has provided flexibility in learning, increased student interaction and engagement and focused on a constructivist approach to teaching (Goodyear, 2015; Martin, Kreiger & Apicerno, 2015; Trinidad & Ngo, 2019). Even though technologies are readily available and accessible, university teachers' technology integration in teaching varies (Ajjan & Hartshorne, 2008). With the potential for technology to enhance learning (Ajjan & Hartshorne, 2008; Appana, 2008; Garcia-Morales, Martín-Rojas & Garde-Sánchez, 2020; Jamil & Shah, 2011; Kustandi, Fadhillah, Situmorang, Prawiradilaga & Hartati, 2020; Renes & Strange, 2011; Zaneldin, Ahmed & El-Ariss, 2019; Zhao, Alexander, Perreault, Waldman & Truell, 2009), there is a need to examine how knowledge, self-efficacy and technology value influence university teachers' technology use in teaching.

This chapter presents a critical review of the research and literature that provides a background to this study. The first section presents an overview of technology use in higher education. The second section examines theories and empirical evidence related to three factors influencing university teachers' technology use in teaching. These theories include Mishra and Koehler's (2006) TPCK Framework to explore knowledge, Bandura's (1977) Theory of Self-Efficacy to explore self-efficacy and Eccles et al.'s (1983) Expectancy-Value Theory to explore technology value. This chapter concludes by outlining the main findings from the reviewed literature. It highlights gaps evident from the review and provides a detailed description of how the current study addresses these gaps.

2.2 Challenges in higher education

Australian universities are central to the overall development and success of society (Nelson, 2003). As they are responsible for preparing students for future careers, universities must continually strive for academic excellence, quality teaching and learning and research eminence (Goodyear, 2015; Laurillard, 1993; Ramsden, 1992). In higher education, there is an expectation that universities will address a number of challenges, such as equity and access for a diverse range of students, quality teaching and learning and technology use (Nelson, 2003; Russell, Malfoy, Gosper & McKenzie, 2014). As advancements in technology have led to the use of the internet, digital devices and learning management systems, university teachers have an increasingly complex role. This complexity emerges as teaching is

no longer wedded to the face-to-face lecture and tutorial. Instead, technologies provide the freedom and flexibility that bring more choice and decision in teachers' learning design (Gosper, McKenzie, Pizzica, Malfoy & Ashford-Rowe, 2014).

The Australasian Council on Open, Distance and e-Learning (ACODE) outlined eight benchmarks for technology use in higher education to bring a consistent approach to the use of eLearning in Australian universities and, further, to provide universities with a way 'to mediate a level of quality in their [teaching and learning] practice' (Sankey & Padro, 2015, p. 2). These benchmarks include:

> (1) an institution-wide policy and governance for technology enhanced learning, (2) planning for institution-wide quality improvement of technology-enhanced learning, (3) information technology systems, services and support for technology enhanced learning, (4) the application of technology enhanced learning services, (5) staff professional development for the effective use of technology enhanced learning, (6) staff support for the use of technology enhanced learning, (7) student training for the effective use of technology enhanced learning and (8) student support for the use of technology enhanced learning (p. 2).

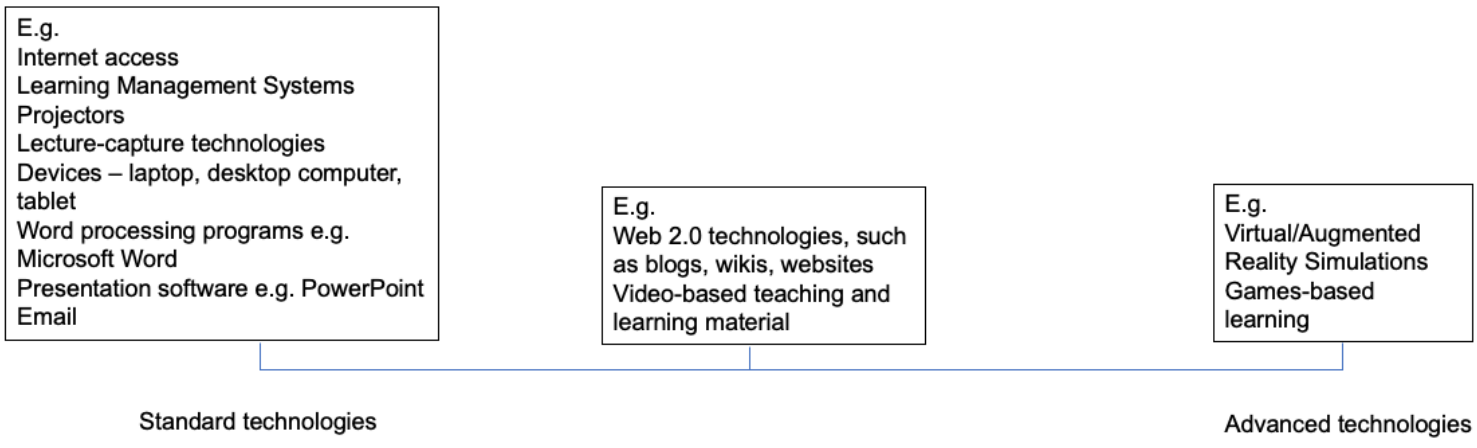
These benchmarks, along with current literature, show that universities and their teachers have responsibilities in planning for, supporting and using technologies in practice to meet the demands of a technological society and to prepare students for future professional practice (Goodyear, 2015; Sankey & Padro, 2015). Research has shown that for students to be prepared for the workforce they need to engage in technology-rich learning experiences promoting critical thinking, problem solving, decision making and the development of communication and digital literacy skills (Vlachopoulos & Makri, 2017). As highlighted by Russell, Malfroy, Gosper and McKenzie (2014), 'universities need to make strategic choices about what technologies to adopt and how best to support…the use of these technologies' (p.1). Some disciplines in higher education are also guided by technology competencies. For example, the Teacher Educator Technology Competencies 'encourage teacher educators to design instruction that utilises content-specific technologies to enhance teaching and learning; incorporate pedagogical approaches that prepare teacher candidates to effectively use technology; and support the development of the knowledge, skills and attitudes of teacher candidates as related to teaching how technology is used by learners in their content area' (Foulger, Graziano, Schmidt-Crawford & Slykhuis, 2017, p.431). Thus, this highlights the push for university teachers to be competent users of technology and further, use technologies innovatively in their teaching. To explore how technology has influenced teaching and learning in higher education, the following section will provide an overview of technology integration in tertiary education.

2.3 An overview of technology integration in higher education

Educational technologies have now become an integral component of teaching and learning in higher education. Student learning has been transformed through the introduction of institutional technologies and the use of online teaching and learning environments (Alemu, 2015; Singh, O'Donoghue & Worton, 2005). Distance education, blended learning and flipped-classroom approaches offer more flexibility in learning and make education more accessible to a diverse range of students (Gedik, Kiran & Ozden, 2012; Ilgaz & Gulbahar, 2017; Shand & Glassett, 2018). Learning management systems provide a platform for students to access and engage with content, drive their own learning and engage in interactions with peers and their instructor (Adzharuddin & Ling, 2013; Alias & Zainuddin, 2005; Chaubey & Bhattacharya, 2015). Whilst universities still practice traditional methods of teaching, the 21st century has seen learners carry portable devices, such as tablets or laptops, around campus to view online lectures, take notes during class and study (Goodyear, 2015). Through the use of web-based systems and online resources, universities aim to provide flexible, innovative ways for students to engage in learning.

Figure 1 highlights standard and more advanced technologies used in higher education for teaching and learning. This figure, developed through a review of six articles on technology use in higher education, takes into account the history of educational technologies, Web 1.0, Web 2.0 and Web 3.0 technologies and current research evidence (Al-Dheleai & Tasir, 2017; Andujar, 2016; Brodahl & Hansen, 2014; Erturk, 2016; Marzelli et al, 2014; Tyagi, 2012; Vlachopoulos & Makri, 2017). Thus, the articles were selected to identify the types of educational technologies available in higher education as identified in the literature.

Figure 2.1 – Standard and advanced technologies in higher education



The introduction of technology in higher education and the use of online learning means that teachers have choices in the technologies they can use in their teaching (Edwards & Bone, 2012; Halac & Cabuk, 2013; Hew & Cheung, 2013; Jamil & Shah, 2011). Research has shown that technology has the potential to enhance learning, and has shaped the way university teachers communicate, coordinate, collaborate and distribute resources to their students (Jamil & Shah, 2011; Trinidad & Ngo, 2019; Zhao, Alexander, Perreault, Waldman & Truell, 2009). Historically, teaching was considered to be a matter of knowledge transmission from instructor to student, showing the central role instructors played in the learning process. However, with the integration of technology in teaching, student-centred approaches have become widespread (Barnett, Keating, Harwook & Saam, 2004; Calderón, Meroño, & MacPhail, 2020; Trinidad & Ngo, 2019). Online learning environments have placed students at the centre of learning and given them a more active role in directing learning activities. Web 2.0 tools, such as, wikis, blogs and social networking, have moved teachers away from creating experiences where students use the internet purely to search for course-related information to creating experiences where students develop connections amongst content and create information that can be shared with others (Al-Mukhaini, Al-Qayoudhi & Al-Badi, 2014; Chawinga, 2017; Dole, 2013).

The affordances of technology use in higher education can be associated with the use of Web 2.0 tools, blended teaching and learning approaches and accessibility to online resources (Kurelovic, 2016; Moghavvemi, Sulaiman, Jaafar & Kasem, 2018; Pursel & Xie, 2014; Stockwell, Stockwell, Cennamo & Jiang, 2015). Studies into the use of Web 2.0 tools, such as blogs (Pursel & Xie, 2014) and YouTube (Moghavvemi, Sulaiman, Jaafar & Kasem, 2018), have shown that these technologies have the potential to complement teaching and learning through allowing access to course-related material and providing a means to share, communicate and collaborate with peers. Pursel and Xie's (2014) research explored university students' blogging data over a two-year period, finding a relationship between blogging over time and student performance. Moghavvemi, Sulaiman, Jaafar and Kasem's (2018) study investigated university students' perceptions of using YouTube for learning, finding that YouTube is effective in enhancing student learning if the content is appropriate to the subject.

Blended learning, also referred to as hybrid learning, is an educational approach that combines face-to-face delivery with online learning. The affordances of this approach are in its ability to place students at the centre of learning, allowing them to actively engage with content, interact with peers and receive immediate feedback. A study undertaken by Stockwell, Stockwell, Cennamo and Jiang (2015) into the use of blended learning in an undergraduate biochemistry course at Columbia University has found that replacing textbooks with video assignments and traditional lecturing with active, student-centred problem-solving was associated with higher assignment completion rates and increased student attendance. Video assignments were shown to be more engaging and of interest to students, while active engagement in problem-solving promoted a deeper understanding of course content. Case studies undertaken by Verhaart (2010) and Perez-Marin and Pascual-Nieto (2010) also highlighted the

advantages of using a blended-learning approach and showed that incorporating learning management systems, online modules, blogs and wikis into this approach resulted in positive experiences for staff and students. However, research has shown that some blended-learning designs can be more effective than others. This was shown in Sirakaya and Ozdemir's (2018) research examining a sample of 66 university students, which found that a flipped-classroom approach was more successful than a traditional blended-learning model, as students came to class prepared, there was an increase in interaction between students and teachers and students had the opportunity to receive immediate feedback.

Online resources have become readily available through the Open Educational Resources (OER) movement, and have brought a number of benefits to teaching and learning in higher education. The OER movement, which has flourished in the last 10 years, has commonly been described as 'materials used to support education that may be freely accessed, reused, modified and shared by anyone' (Pegler, 2013, p. 148). This movement has seen university teachers repurpose existing educational material, including 'full courses… modules, textbooks, streaming videos… and any other tools, materials, or techniques used to support access to knowledge' (Atkins, Brown & Hammond, 2007, p. 4). Through the use of OER, students can engage in personalised learning, access different education-based materials suitable to their preferred learning approach and become more-active participants who collaborate in virtual communities (McGreal et al., 2013). OER further promotes equity through increasing the availability of knowledge, as students are able to learn anywhere, anytime. Kurelovic's (2016) research exploring 64 university teachers' attitudes at four Croatian institutions showed that the majority of academics supported the use of OER and believed in the customisation of these resources for teaching. As evident in this research, OER introduced new ways of teaching and learning as traditional methods can be seen to be 'enriched with open education materials and online tools which can be used without limitations both in online or in standard teaching' (Kurelovic, 2016, p. 141). Through the use of such resources, teaching environments can include collaboration and constructivist learning, the critical examination of content and the creation and exchange of knowledge.

The integration of technologies in higher education has also posed several challenges, such as access to technology-based resources and the adoption of technologies in teaching (Habibu, Al-Mamum & Clement, 2012; John, 2015). Early literature revealed issues concerning university teachers' access to technological resources (Beeson, Journell & Ayers, 2014; Singh, O'Donoghue & Worton, 2005). However, as technologies have become more readily accessible, new challenges associated with the adoption and use of technologies in teaching have emerged (Dlalisa & Govender, 2020; Lin, Dyer & Guo, 2012; Swier, 2018). Higher-education institutions expect that university teachers will use an array of technology-based tools in their teaching, employ active-learning methodologies and maintain an online presence through collaboration with students (Lin, Dyer & Guo, 2012; Singh, O'Donoghue & Worton, 2005). This online approach places students at the centre of teaching and learning, and educators are tasked with acting as guides and facilitators. With the integration of technologies into design and practice, the roles, relations

and practices of students and teachers have been reconstructed, and teachers are expected to effectively use technologies in their teaching (Lin, Dyer & Guo, 2012).

Research evidence has highlighted specific challenges concerning the use of learning technologies. These challenges include limited knowledge of how to effectively embed technologies into practice, the influence of experiences and perceptions on one's abilities to use technologies in teaching and the impact of varying attitudes and beliefs towards technology integration. A study by Godwin and Jones (2012) found that the use of learning management systems can present challenges to university teachers, as the integration of technologies into teaching may not be based on effective pedagogical practices. Rienties, Brouwer and Lygo-Baker's (2013) research undertaken on 73 academics and nine higher-education institutions investigated the outcome of a teacher-training program on teachers' knowledge of technology use in teaching, finding that through engagement in the program, teachers' technological, pedagogical and content knowledge increased. A study by Osika, Johnson and Buteau (2009) showed that factors influencing university teachers' technology use in online teaching included perceptions and experiences with technology. This study's findings highlighted that negative experiences with technology, even in face-to-face environments, can lead to avoidance. Ajjan and Hartshorne's (2008) research on faculty members' beliefs towards Web 2.0 technologies showed that attitude and perceived behavioural control can strongly affect a university teacher's intentions to use technology in teaching.

In sum, it is clear that the introduction of technologies in higher education has supported a shift in the use of traditional pedagogical methods, with online learning environments allowing increased communication, collaboration and access to resources that address a variety of learning approaches. With the introduction of technology have come new instructional methods, such as blended learning, and resources, including OER. Although institutions are providing teachers with access to a number of institutional technologies, teachers need to carefully consider whether these resources are appropriate to their academic discipline and the learning objectives of their subject (Brinthaupt, Fisher, Gardner & Raffo, 2017). While university teachers are experts in their chosen area of research and discipline, they do not necessarily have the knowledge, self-efficacy or technology value needed to integrate technologies in their teaching (Al-RSA, 2012, Bhati, Mercer, Rankin & Thomas, 2009; Roblyer et al., 2010). Teachers need to engage in appropriate professional development to increase knowledge construction and develop their self-efficacy; however, teachers also need to see the value of technology use in the context of their academic discipline and subject area. The next section will explore the factors of knowledge, self-efficacy and technology value on university teachers' technology integration in teaching.

2.4 Factors affecting technology integration in higher education

From a review of the literature on teachers' technology integration, three key factors can be identified that have helped to explain variations in teacher's technology use in higher education: knowledge, self-efficacy and the value that teachers place on technology use (Benson & Ward, 2013, Chen et al. 2019 Khan, 2011; Mishra & Yahya, 2007; Horvitz, Beach, Anderson & Xia, 2015; Robinia & Anderson, 2010; Ajjan & Hartshorne, 2008). These factors have been cited across multiple research studies and further, proven to be compelling issues explored in the literature on effective technology integration. Thus, this research aims to explore the three theoretical constructs in a single study to see whether they can provide a more comprehensive explanation of university teachers' technology adoption in teaching. Whilst other factors, such as a lack of technological resources, have been explored in earlier studies, these factors are now starting to become obsolete as access to educational technologies increases (Chen et al. 2019). To explore knowledge, self-efficacy and technology value and how these factors influence teachers' decisions to use technology in teaching, the following section will include three key sub-sections: the first will explore the factor of knowledge, the second self-efficacy and the third technology value. Each of these sub-sections will be accompanied by a description of the theoretical framework and an analysis of empirical evidence. This section will conclude by addressing the relationship between these factors and how the proposed research study will address gaps identified through a review of literature.

2.4.1 Knowledge and its influence on technology integration in higher education

Knowledge has been shown to have an influence on teachers' technology use. A considerable amount of research has used TPCK to explore teacher knowledge in schools and for pre-service teachers (e.g. Bas & Senturk, 2018; Evans, Nino, Deater-Deckard & Chang, 2015; Erduran & Ince, 2018; Handal, Campbell, Cavanagh, Petocz & Kelly, 2013; Harris & Hofer, 2011; Hofer & Swan, 2008; Huseyin, 2015; Karakaya Cirit & Canpolat, 2019; Koh, Chai & Tsai, 2010; Owusu, Conner & Astall, 2015; Pamuk et al., 2015; Yildiz & Gokcek, 2018). These studies have focused on teachers' perceptions of knowledge, the measurement of teachers' TPCK and the development of TPCK through professional learning. A smaller body of literature exists on university teachers' TPCK in higher education (e.g. Benson & Ward, 2013; Chen, Liao, Chang, Hung & Chang, 2019; Fabian, Clayes & Kelly, 2019; Khan, 2011; Koehler, Mishra & Yahya, 2007; Mei, Aas & Medgard, 2019; Mostert & Quin, 2009). This research has focused on the knowledge that university teachers need to integrate technologies effectively into their teaching. With limitations to the research available on university teachers' knowledge and technology integration, a more in-depth understanding of this area is needed.

TPCK is a conceptual framework that highlights the knowledge base that teachers need to effectively integrate technology into their teaching (Mishra & Koehler, 2006). This framework is built upon the notion that technology integration in a specific educational context relies on the careful alignment of technology, pedagogy and content (Voogt, Fisser, Roblin & Tondeur, 2012). TPCK addresses teachers' knowledge development and acknowledges that effective technology integration includes the complex interplay between all pairs of knowledge (pedagogical-content, technological-content, technological-pedagogical) and the relationship among them (TPCK) (Mishra & Koehler, 2006). Through the introduction of this framework, teachers are inspired to reevaluate their knowledge and use of technology in the classroom (Cox & Graham, 2009). To explore the factor of knowledge and its influence on technology integration, the next section provides a detailed description of the TPCK Framework and addresses empirical evidence related to the influence of knowledge on technology use in teaching.

2.4.1.1 Technological, pedagogical content knowledge (TPCK)

Teaching is a complex activity that draws on multiple forms of knowledge. It focuses on access to an ordered system of knowledge, including knowledge of how students learn and knowledge of discipline-specific content. Historically, teacher education focused on the delivery of content knowledge, specifically the key understandings and skills of a particular field (CK) (Shulman, 1987). Teachers needed to be competent in passing knowledge about their discipline to students, including information about facts and theories. However, a shift in education saw the primary focus of teacher education change to competency in pedagogy (PK), which 'emphasized general pedagogical classroom practices independent of subject matter, usually at the expense of content knowledge' (Mishra & Koehler, 2006, p. 1020). Pedagogical knowledge and content knowledge were viewed independently, and one form of knowledge was considered to be the dominant focus of teaching. However, Shulman's work (1989) moved away from this idea, introducing the concept of pedagogical content knowledge (PCK). Rather than viewing pedagogical knowledge and content knowledge separately, Shulman (1989) proposed a relationship amongst these knowledge forms. PCK, the intersection between pedagogy and content, focused on the blending of pedagogical knowledge and content knowledge. Although, teachers need to understand the difference between pedagogical knowledge and content knowledge, this understanding alone is not sufficient for good teaching. PCK also involves an understanding of how subject matter can be organised and adapted for learning and how effective teaching transforms and represents subject matter in a way that is accessible to all learners, regardless of their learning styles and abilities.

Pedagogical content knowledge still has important implications for today's education system. However, the introduction of digital devices, software and learning management systems has seen teaching and learning spaces transform, with technology being placed at the forefront of educational practice. Digital technologies have influenced the way teachers design for learning, specifically how technology can be used to assist the representation and explanation of subject matter. Thus, teachers are required to move beyond simply knowing how to operate technology (for example, specific hardware and software skills) to

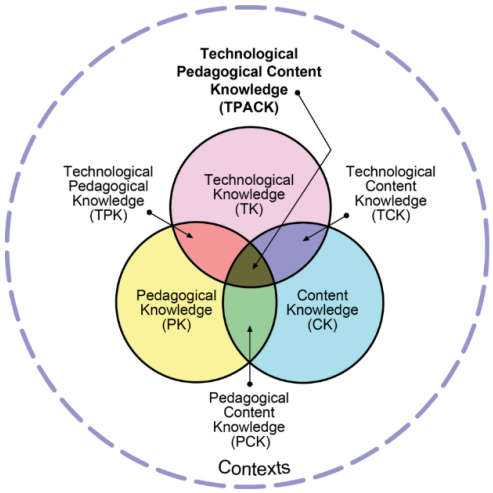
being able to effectively include technologies in their design of teaching and learning. In 2005 Mishra and Koehler introduced the term technological, pedagogical, content knowledge as a conceptual framework addressing the knowledge teachers require to integrate technologies successfully into their teaching. This framework highlights that successful technology integration includes the complex interplay between all pairs of knowledge (PCK, TCK, TPK) as well as the relationship between the three knowledge forms (TPCK) (Mishra & Koehler, 2006). TPCK is further explored below through addressing each element and their relationship.

Content knowledge focuses on the specific subject matter of a discipline area. Subject matter varies greatly across different disciplines, with information taught in engineering being vastly different to that taught in history or arts. There is an expectation that teachers possess knowledge of their specific discipline area, as well as knowledge that information differs from one discipline to another (Mishra & Koehler, 2006). Pedagogical knowledge, on the other hand, addresses the practices of teaching and learning. This form of knowledge focuses on how students learn, how to design and plan for learning experiences and how to assess student learning. Deep pedagogical knowledge revolves around an understanding of knowledge construction and the application of learning theories to practice (Mishra & Koehler, 2006). The final form of knowledge, technological knowledge, involves an understanding about standard forms of technology and more-advanced forms and the skills involved in using different technologies. For example, this includes knowledge of how to use word-processing programs, the internet and email facilities. Thus, technological knowledge focuses on continually learning how to use technologies, especially new and upcoming technologies, as technology currently changes.

Pedagogical content knowledge aligns teaching practices with the delivery of discipline-specific content. It focuses on how to effectively communicate subject matter through using methods and strategies that arrange information into a logical structure for learning. As mentioned above, PCK does not focus on general pedagogical strategies available across all discipline areas; instead it involves teachers assessing what strategies and methods are relevant to teaching in their discipline. It involves ‘the representation and formulation of concepts, pedagogical techniques, knowledge of what makes concepts difficult or easy to learn, knowledge of students’ prior knowledge and knowledge of epistemology’ (Mishra & Koehler, 2006, p. 1027). Technological content knowledge (TCK) focuses on the relationship between technology and content and addresses how these two knowledge forms can influence and constrain one another. TCK involves teachers understanding how subject matter can change with the use of certain technologies, which technologies are best suited to their content matter and the effect that content can have on the selection of specific technologies and vice versa. In contrast, technological pedagogical knowledge addresses how various technologies have a range of different purposes, affordances and limitations. It is imperative that teachers understand affordances of technology and how they are modified within various contexts and for different purposes (Mishra & Koehler, 2006).

Each knowledge form (PK, CK, TK) and their pairings (PCK, TPK, TCK) do not in themselves lead to successful technology integration. Rather, it is the combination of all three knowledge forms (TPCK) that allows for the successful integration of technology (Mishra & Koehler, 2006). TPCK moves beyond knowledge centred only on subject content, technological expertise and general pedagogical practices, and refutes the idea that one single technological solution is relevant to all teachers, academic courses or subjects and ways of teaching. Instead, an understanding of the relationship between technology, pedagogy and content is needed to develop strategies appropriate to one's discipline. Thus, TPCK is a way to bring about effective technology integration. The framework addresses a) how concepts can be represented using technologies; b) how pedagogy needs to integrate technologies in a productive manner so students can learn content; c) how technology can assist students in learning challenging content; and d) how technologies can build upon students' prior knowledge and either develop new epistemologies or refine pre-existing ones (Mishra & Koehler, 2006).

Figure 2.2 – TPCK Framework (Mishra & Koehler, 2006)



A considerable amount of research has used TPCK to explore teacher knowledge in schools and teacher-education programs, specifically addressing the knowledge of pre-service teachers (Evans, Nino, Deater-Deckard & Chang, 2015; Handal, Campbell, Cavanagh, Petocz & Kelly, 2013; Hofer & Swan, 2008; Huseyin, 2015; Koh, Chai & Tsai, 2010). This research, using either qualitative methods (e.g. case study approach – Hofer & Swan, 2008), quantitative methods (e.g. survey, instrument design – Koh, Chai & Tsai, 2010) or a combination of both methodologies (e.g. mixed methods –Trautmann & Makinster, 2010) focuses on exploring teachers' perceptions of knowledge, TPCK in different subject domains and the measurement of teachers' TPCK.

Teachers' perceptions of TPCK are explored in research on pre-service teachers and in-service teachers (Adeoye & Ojo, 2014; Huseyin, 2015; Koh, Chai & Tsai, 2010; Lin, Tsai, Chai & Lee, 2013; Luik, Taimalu & Suviste, 2018; Redmond & Lock, 2019). The influence of demographic characteristics on 222 pre-service and in-service science teachers' perceptions of TPCK is examined in Lin, Tsai, Chai and Lee's (2013) research, which focused specifically on the affordances of technology in teaching. Their findings showed that a relationship existed between teachers' TPCK and demographic characteristics, such as teaching experience, gender and age. However, this does not correlate with the research of Koh, Chai and Tsai (2010), who in their study of 1,185 pre-service teachers, did not find a significant relationship between TPCK and age or TPCK and teaching level. In relation to teachers' gender and its influence on TPCK, their research showed that male pre-service teachers rated their TK to be higher than females (Koh, Chai & Tsai, 2010). Teachers' perceptions of TPCK are also seen in the research of Luik, Taimalu and Suviste (2018), which explored how 413 pre-service teachers perceived their TPCK. Their findings showed that 'teachers lack pedagogical knowledge, but they perceive that they are good at integrating technology into their teaching' (Luik, Taimalu & Suviste, 2018, p. 741).

Research has addressed pre-service and in-service teachers' TPCK when teaching in different subject domains, such as social studies (e.g. Doering, Veletsianos, Scharber & Miller, 2009; Harris & Hofer, 2011; Manfra & Hammond, 2009), mathematics (e.g. Hofer & Grandgenett, 2012; Osmantar, Akkoc, Bingolbail & Demir, 2010) and science (e.g. Jang & Chen, 2010; Jimonyannis, 2010; Niess 2005). Manfra and Hammond's (2009) research explored teachers' use of student-created digital documentaries in a social-studies classroom. Jimonyannis's (2010) research focused on the development of the technological, pedagogical, science knowledge framework, which addressed TPCK in science education. Addressing teachers' TPCK across different subject areas has revealed challenges. For example, So and Kim's (2009) research on 97 pre-service primary teachers found that these participants were challenged when applying their knowledge to the design of technology-based teaching and learning experiences. Further, this study also found that teachers' TPCK differed across subject areas. Research has also addressed different pedagogical approaches to the TPCK framework. For example, Dong et al.'s (2015) research addressed pre-service and in-service teachers' TPCK in relation to constructivist teaching approaches.

Several research studies have addressed the development of valid and reliable instruments for measuring pre-service (e.g. Pamuk et al., 2015; Shinas et al., 2013) and in-service teachers' (e.g. Archambaulth & Barnett, 2010) TPCK. Research in this area has been conducted in a number of countries, such as Taiwan (Shih & Chuang, 2013), Singapore (Koh, Chai & Tsai, 2010) and the USA (Kopcha et al., 2014). Different focuses of this research are evident, such as the development of TPCK instrument for teachers working within the same content areas (e.g. Lin et al., 2013) or using instruments to explore the relationship that exists among TPCK components (Pamuk et al., 2015). From reviewing research in this area, it was found that instruments can include 5-point Likert Scales (e.g. Kopcha et al., 2014; Schmidt et al., 2009) and 7-point Likert scales (e.g. Koh, Chai & Tsai, 2010).

While TPCK has been largely used to explore pre-service and in-service teachers' technology use, a smaller body of literature is available on university teachers' TPCK in higher education. Studies in higher education have used TPCK to assess teacher practice and present challenges associated with teachers' TPCK (Benson & Ward, 2013; Khan, 2011; Koehler, Mishra & Yahya, 2007). For example, research using TPCK as a framework for assessing teacher practice was undertaken at a large midwestern US university (Benson & Ward, 2013). Three experienced university professors who held advanced graduate degrees in the college of education and had taught online for a minimum of three years were investigated. Face-to-face interviews taken mid-way through a 16-week semester and online observations revealed that technological knowledge alone does not allow for sufficient TPCK. Further, another study exploring the relationship between technology, pedagogy and content used quantitative discourse analysis to investigate 6 faculty members and 18 graduate students who worked collaboratively to design an online learning environment (Koehler, Mishra & Yahya, 2007). The study found that through the design of this collaborative online environment, the participants moved from viewing technology, pedagogy and content as individual constructs to viewing them as co-dependent.

Research into teacher TPCK in higher education has highlighted challenges when using technology as a tool for learning. Al-RSA's (2012) research highlights that university teachers with a limited teaching background and knowledge of pedagogy struggle to use technology in ways that enable higher-order thinking, especially in the disciplines of engineering and science. From the questionnaire data collected on 40 faculty members at Al Hussein Bin Talal University in Jordan, the researchers pointed out that engineering and science teachers 'showed… a low degree of knowledge to achieve learning in an exploratory context that requires higher-order thinking skills' (Al-RSA, 2012, p. 92). This research showed the limited knowledge that these teachers had in using technology in a constructivist learning environment, and the consequent limit to the activities that they could provide to their students.

Through an analysis of the research on university teachers' TPCK in higher education settings, some major themes emerged, such as: university teachers' TPCK development (e.g. Ansyari, 2015; Arinto, 2013; Kennedy, 2015) and university teachers' knowledge, beliefs and attitudes (e.g. Cabero & Barroso, 2016; Jaikaran-Doe & Doe, 2016). Research undertaken in the area of university teachers' TPCK development focused on the impact of numerous approaches on one's TPCK. The most common approaches were design-based experiences (e.g. Ansyari, 2015), workshops (e.g. Ansyari, 2015), mentoring (e.g. Fleagle, 2012) and online professional development (e.g. Alsofyani, bin Aris, Eynon, & Majid, 2013). For example, research on the influence of mentoring has shown increased interest from university teachers' when individualised support is offered from faculty developers and peers targeting connections amongst TPCK domains in a specific discipline (Fleagle, 2012). On the other hand, research exploring university teachers' knowledge, beliefs and attitudes focused on the unique nature of university teachers' TPCK (e.g. Ansyari, 2015) and the impact of demographic factors on one's TPCK (Alzahrani, 2015). Various results have emerged from research addressing the impact of demographic factors on

university teachers' TPCK with Alzanhrani's (2015) research finding that younger faculty generally had higher TPCK than their older colleagues and Garrett (2014)'s research opposing these findings by stating that higher ranked staff had significantly higher levels of TPCK than their junior colleagues. Thus, higher education institutions present unique contexts for TPCK and its development. Whilst extensive research has been undertaken on pre-service and in-service teachers, there is a need to understand the contextual factors that influence university teachers' decisions to use technology in higher education settings, as each educational setting is unique and varied (Evans, Nino, Deater-Deckard & Chang, 2015; Handal, Campbell, Cavanagh, Petocz & Kelly, 2013; Hofer & Swan, 2008; Huseyin, 2015; Koh, Chai & Tsai, 2010).

As identified above TPCK was introduced as a conceptual framework guiding the knowledge domains teachers needed to successfully integrate technology into their teaching. Whilst this framework has been explored extensively, it has received criticism from numerous researchers about it explanatory depth and conceptual validity (e.g. Angeli & Valanides, 2009; Archambault & Barnett, 2010; Cox, 2008; Doering, Veletsianos, Scharber & Miller 2009; Graham, 2011; Kelly, 2008; Phillips, 2015; Swallow & Olofson, 2017; Willermark, 2018). For example:

- Angeli and Valanides (2009) stressed that the TPCK framework is not fully understood. The explanations of technological pedagogical content knowledge and associated constructs are not clear for researchers to decide on examples for each construct. Thus, Archambault and Barnett (2010) along with Willermark (2018) argued that the TPCK framework is not practically useful. Further, they also outlined that TPCK provides incomplete and inaccurate definitions of the knowledge domains;
- Doering, Veletsianos, Scharber and Miller (2009) refuted Mishra and Kohler's (2006) idea that knowledge domains are equal. Instead, they highlighted that 'teachers do not use all three of [TPCK'S] knowledge domains equally" (p. 336);
- Graham (2011) stressed that there is difficulty distinguishing between the knowledge domains, which is most likely resulting from the lack of clarity around the constructs;
- Swallow and Olofson (2017) argued that 'although TPCK is grounded in context, one limitation is the lack of understandings about the interactions between particular contexts, knowledge development, and instruction;
- Cox (2008), Kelly (2008) and Phillips (2015) explained that TPCK development is challenging to measure because knowledge must be obtained and exhibited in a specific context. Cox (2008) elaborated by stating that 'the effect of context is that TPCK is unique, temporary, situated, idiosyncratic, adaptive, and specific and will be different for each teacher in each situation' (p.47) therefore alluding to the point that 'any true example of TPCK must necessarily include the context of that example' (p.48). Mishra and Koehler (2006) acknowledged the impact of context on teacher's TPCK by stating that 'no single technological solution applies for every teacher, every course, or every view of teaching (p.1029). However, research by Porras-Hernández and

Salinas-Amescua (2013) called for different understandings of context in the TPCK framework as they believe that 'the original TPCK framework is limited in that it defines the contexts in which teachers work too narrowly. In fact, the majority of published work refers to the context element in a rather general manner' (p.224). Further, Phillips (2015) proposed that Mishra and Koehler's (2006) definition of context must be elaborated upon to include practice and identity.

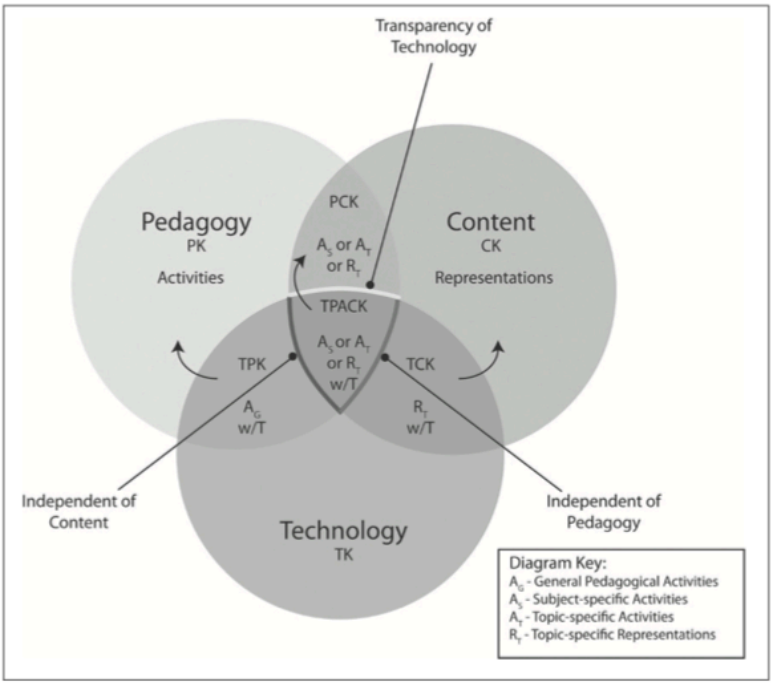
Thus, criticisms of the TPCK framework have shown that a level of abstraction exists when teachers are working with knowledge domains offering no clear guidance on how to define or rate a teacher's level of TPCK. Research by Cox and Graham (2009) attempted to address this gap by focusing on a conceptual analysis that produced a more elaborate model of the TPCK framework, specifically key features of each construct and the boundaries between them. Findings of their research provided a more comprehensive model of the TPCK framework and included precise definitions 'in order to focus on the utility of this elaborated model for classifying cases' (Cox & Graham, 2009, p.62). The elaborated TPCK framework defines each of the constructs as follows:

Table 2.1 – Elaborated definitions of TPCK (Cox & Graham, 2009)

Construct	Elaborated definitions
Pedagogical Knowledge (PK)	'The definition of pedagogical knowledge is simplified to focus on a teacher's knowledge of the general pedagogical *activities* that she might utilize. General activities are independent of a specific content or topic (meaning they can be used with any content) and may include strategies for motivating students, communicating with students and parents, presenting information to students, and classroom management among many other things. Additionally, this category includes general activities that could be applied across all content domains such as discovery learning, co-operative learning, problem-based learning, etc. Although this approach focuses on a narrower feature of pedagogical knowledge than some may be comfortable with, examining pedagogy in this way helps to illuminate the differences between the TPACK constructs' (Cox & Graham, 2009, p.62).
Content Knowledge (CK)	'In this [elaborated] framework, content knowledge is simplified to indicate a knowledge of the possible topic-specific representations in a given subject area. This knowledge is independent of pedagogical activities or how one might use those representations to teach' (Cox & Graham, 2009, p.62).
Pedagogical Content Knowledge (PCK)	'Pedagogical content knowledge as conceived by Shulman (1986, 1987) has been re- searched extensively. However, there are many different conceptions or models of what kind of knowledge is part of PCK, which has made the construct difficult to research (Marks, 1990). Van Driel, Verloop, and Vos (1998) compare five of the prominent models of PCK and an understanding of strategies and representations are represented in four of five. Pedagogical content knowledge combines knowledge of activities (or strategies) and knowledge of representations in order to facilitate student learning. The knowledge of pedagogical activities here is content-specific rather than general because PCK is situated in a particular subject area. This knowledge is divided into knowledge of subject-specific activities and topic-specific activities. Subject-specific activities can be used across topics in a given discipline. Topic-specific activities are unique to teaching particular concepts within a discipline. Pedagogical content knowledge also includes understanding of the topic-specific representations in a given discipline and how they might be used as part of the teaching activities to promote student learning. Thus, a teacher with PCK knows how to utilize topic- specific

	representations in conjunction with subject- or topic-specific activities to help students learn' (Cox & Graham, 2009, p.63).
Technological Knowledge (TK)	'In this [elaborated] framework, technological knowledge is defined as knowledge of how to use emerging technologies. The definition is con- fined to emerging technologies in order to illus- trate the difference between TPACK and PCK. By defining technology as emerging technolo- gies here, I hope to further focus the discussion on technologies that are not yet transparent in the context under consideration. For example, books were once considered technology–a tool that was easier to use and had more capacity than a scroll' (Cox & Graham, 2009, p.63).
Technological Content Knowledge (TCK)	'In the elaborated model of TPACK that we propose here, TCK refers to a knowledge of the topic-specific representations in a given content domain that utilize emerging technologies. While the focus on representations does not fully represent the bidirectional relationship of content and technology, it does illuminate what we found to be the most prac- tical and widespread form of TCK for teachers' knowledge of how to represent concepts with technology. The knowledge of these rep- resentations exists independent of knowledge about their use in a pedagogical context. As the technologies used in the representations be- come mainstream, that knowledge transforms into content knowledge. For example, graph- ing calculators were once considered emerging technologies in mathematics, but knowledge of how they facilitate mathematical representations is now part of the content of mathematics itself. Alternatively, software for three-dimen- sional modeling of numerical data, such as GraphCalc, is an emerging technology. Knowl- edge of how it facilitates content representation would be considered TCK, while knowledge of how the traditional graphing calculator facilitates those representations would be CK' (Cox & Graham, 2009, p.64).
Technological Pedagogical Knowledge (TPCK)	'In the elaborated model, TPK is a knowledge of the general pedagogical activities that a teacher can engage in using emerging technologies. Thus, TPK might include knowledge of how to motivate students using technology or how to engage students in cooperative learning using technology. Again, these activities are independent of a specific content or topic not because they don't involve content, but because they can be used in any content domain. As the technologies being used become transparent or ubiquitous, TPK transforms into pedagogical knowledge as the emphasis on the technology is no longer needed. For ex- ample, while the overhead projector was once considered a new tool that could be used in the classroom to facilitate presentation, its use in teaching is now mainstream. However, interactive whiteboards, which utilize digital projectors and allow the teacher and students to interact with projected content, are considered emerging technologies and are not yet ubiqui- tous in the classroom. Knowledge of how to use these interactive boards for general pedagogi- cal purposes, then, would be considered TPK while knowledge of how to use the traditional whiteboard for the same purposes is PK' (Cox & Graham, 2009, p.64).
Technological Pedagogical Content Knowledge (TPCK)	'Based on the elaborated model of the framework, TPACK refers to a teacher's knowledge of how to coordinate the use of subject-specific activities or topic-specific activities with topic-specific representations using emerging technologies to facilitate student learning. As the technologies used in those activities and representations become ubiquitous, TPACK transforms into PCK. For example, a teacher may know how to conduct a frog dissection with her students as part of inquiry-based learning in the classroom. Alternatively, she may know how to use an online dissection simulator with her students as part of inquiry-based learning in the form of a WebQuest. Knowledge of how to use the online simulator as part of her subject- specific activities is TPACK, while knowledge of how to conduct a traditional dissection with transparent technologies such as scalpels, paper diagrams, etc., is PCK' (Cox & Graham, 2009, p.64).

Figure 2.3 – Cox and Graham's (2009) Elaborated TPCK Framework



Drawing on the work of Grandgenett (2017), Kelly (2008) and Tajudin and Kadir (2014), the below tables provide a summary of characteristics associated with either high or low TPCK. The work of Grandgenett (2017) and Tajudin and Kadir (2014) strongly focus on mathematics education in pre-service and in-service teacher education and thus, the definitions below surrounding high and low TPCK are based on these contexts.

Table 2.2 - Characteristics of high TPCK

Characteristic	Source	Example/scenario
'Openness to experimentation'	Grandgenett (2017)	A teacher 'will try new technology-based lessons with their students on a regular and sometimes spontaneous basis, confident that if done thoughtfully and interactively, their students could learn something of value each time they attempt something new' (p.19).
'Strives to be consistently on task for the content being taught'	Grandgenett (2017)	A teacher 'with strong TPCK [is] effective at focusing on … concepts, while still taking advantage of the instructional opportunities offered by technology' (p.19).
'Approaches instructions with clear and systematic pedagogical strategies in mind'	Grandgenett (2017)	A teacher 'would strive to know 'where' their students are conceptually, what they need to do to achieve the next step in an instructional process, and 'how' they generally want their students to proceed through careful sequences of classroom interactions and tasks' (p.20).

'Makes connections for their students as to 'why' a particular technology is useful for instructing a particular topic'	Grandgenett (2017)	A teacher 'would consistently offer explanations to their students on what they are doing with the technology, why a specific tool is appropriate for a particular [discipline] situation, and perhaps even how a selected technology fundamentally works' (p.20).
'Recognises that all strategies do not work for all students'	Grandgenett (2017)	A teacher 'considers the cultural relevance of an instructional activity may well be a key to helping them determine how to reach all students' (p.25)
'Not only general technology skills but also knowledge about the types and specific uses of technology that are most likely to facilitate teaching and learning in each subject'	Kelly (2008)	A 'teacher whose level of TPCK is high for example, will not only be skilled with technology applications such as Excel, PPT, digital imaging and hypertext, but will know which ones to use to teach a particular lesson' (p.51).

Table 2.3 - Characteristics of low TPCK

Characteristic	**Source**	**Example/scenario**
'Teachers deliver content at a surface level only'	Tajudin and Kadir (2014)	Content was 'referred without modification and only referring to the textbooks and worbooks provided' (p.736).
'Can choose the appropriate technology to teach a particular subject but they have not been able to fully explore specifically how the software can be integrated into the teaching and learning process'	Tajudin and Kadir (2014)	A teacher 'can choose the appropriate technology to teach a particular subject, but they have not been able to explore specifically how the software can be integrated in teaching and learning process which is very helpful in learning activities and accelerate the process of understanding the concepts' (p.737).

In sum, a review of the TPCK literature has revealed two areas for future investigation. Firstly, there has been considerable research undertaken on pre-service and in-service teachers' TPCK. Whilst some research has explored TPCK in higher education settings, this literature has been limited and warrants further investigation. Thus, there is a need to explore the influence of university teachers' TPCK on technology integration to better understand what enables or constraints technology use. Secondly, previous research has indicated a number of issues with the TPCK framework, specifically difficulty in defining each of the knowledge forms and also a limited understanding of context. This research aims to further explore the contextual factors that influence university teachers' technology integration in teaching.

2.4.1.2 Self-efficacy and its influence on technology integration in higher education

Self-efficacy has been found to influence teachers' technology use in teaching (e.g. Bhati, Mercer, Rankin & Thomas, 2009; Kim & Kim, 2013). Research into self-efficacy and technology integration has been undertaken in schools and in universities. In schools (including research on pre-service teachers), this research has addressed teacher self-efficacy and technology use, teacher self-efficacy and technology-related professional development and teacher self-efficacy and observation of others (e.g. Albion, 2001; Al-Awidi & Alghazo, 2012; Giles & Kent, 2016; Letwinsky, 2017; Rich, Jones, Belikov, Yoshikawa & Perkins, 2018; Sarfo, Amankwah & Konin, 2018). In relation to university teachers, this research has explored teacher self-efficacy and adoption of technology in teaching and the measuring of university teachers' self-efficacy in relation to technology use (e.g. Horvitz, Beach, Anderson & Xia, 2015; Robinia & Anderson, 2010).

Bandura's Theory of Self-Efficacy outlines the beliefs that one has in their abilities to 'organize and execute the courses of action required' in specific domains to lead to the display of particular behaviours and actions (Bandura, 1977, p. 3). This theoretical framework provides an insight into how one's self-efficacy can influence technology use in teaching. To address the factor of self-efficacy and its influence on technology integration in higher education, this section will provide a description of Bandura's Theory of Self-Efficacy, and further address empirical evidence related to the influence of self-efficacy on university teachers' technology use in teaching.

2.4.1.2.1 Bandura's Theory of Self-Efficacy

Self-Efficacy Theory, originating from Social Learning Theory, predicts that an individual will engage in specific activities that they believe they can perform and achieve in specific domains (Bandura, 1977). Self-efficacy influences every aspect of human behaviour, and it is through an individual's belief about themselves that they have the ability to achieve and competently make decisions when faced with challenging tasks. As Bandura (1997) described perceived self-efficacy involves the 'beliefs in one's capabilities to organise and execute the courses of action required to produce given attainments' (p.3). He explained that self-efficacy beliefs impact many aspects of human behavior, such as choice when deciding upon a course of action, the amount and duration of effort, and the emotional response given to the success of an endeavor (Bandura, 1997).

An individual's beliefs about their self-efficacy can be developed through four key sources: mastery experiences, vicarious experiences, social persuasions and physiological factors (Bandura, 1977). These sources vary in their ability to influence self-efficacy beliefs (Artino. 2012). From all four influences, mastery experience was suggested to have the strongest impact on self-efficacy beliefs and behavior (Abbitt, 2011; Artino, 2012). However, the 'influence of these experiences on self-efficacy will vary

depending on whether or not success was achieved as well as the effort required to do so' (Abbitt, 2011, p. 136). Mastery experience refers to an individual's belief in their ability and the influence this has on their self-efficacy. An individual who experiences success when achieving a particular task will have heightened self-efficacy; however, if they fail at this task, this will undermine the beliefs they have about themselves (Bandura, 1977). Vicarious experience, also known as modelling, refers to the influence of another's success and failures on an individual's self-efficacy. When an individual observes another succeed, their own self-efficacy can increase. On the other hand, if they see another fail, their self-efficacy can decrease (Bandura, 1977). Social persuasion refers to the encouragement received from another individual. When encouragement is received, self-efficacy is increased. Discouragement, however, lowers an individual's self-efficacy (Bandura, 1977). Finally, physiological factors can influence an individual's self-efficacy. One's mood, emotions and physical state can influence how an individual interprets their self-efficacy (Bandura, 1977).

Self-efficacy is a predictor of the amount of effort that individuals will place on an activity, how long they will persevere when faced with difficult situations and how resilient they can be when challenged with adversity. An individual with a strong sense of self-efficacy is much more willing to approach a difficult task with more optimism, as opposed to avoiding the task because it is threatening. Individuals with a high level of self-efficacy are generally able to set themselves challenging goals, improve effort when faced with failure and more quickly recover their self-efficacy during unfavorable situations. Contrastingly, people with low self-efficacy may perceive tasks to be more difficult than they really are, and this can lead to feelings of anxiety and stress. In an educational setting, self-efficacy applies to teachers and the tasks they complete. Teacher or instructional self-efficacy is defined as a teacher's beliefs about their abilities to assist student learning. Social Cognitive Theory highlights that a teacher's self-efficacy should affect the same aspects of performance that students' self-efficacy affects, such as the activity they choose to complete, the amount of effort they place into a task, their persistence to complete the task and their achievement (Wentzel & Miele, 2009). Teachers with a higher self-efficacy are more likely to develop activities that are challenging, assist students in the learning process and persist when it comes to students with learning difficulties. In addition to an individual teacher's self-efficacy, there is also collective teacher self-efficacy, which refers to teachers' beliefs about the ability of their faculty to influence student outcomes positively. Thus, context, environment and task-specificity have been found to be central to measuring self-efficacy (Bandura, 1977; Corry & Stella, 2018).

Research into self-efficacy and technology use has been undertaken in a number of educational settings, such as in schools and for pre-service teachers undertaking education programs (Albion, 2001; Letwinsky, 2017; Rich, Jones, Belikov, Yoshikawa & Perkins, 2018; Sarfo, Amankwah & Konin, 2018). This research has largely used quantitative methods (e.g. surveys, questionnaires) and focused on teacher self-efficacy and technology use; teacher self-efficacy and technology-related professional development; and teacher self-efficacy and observation of others.

The relationship between teacher self-efficacy and technology use is evident in several studies on pre-service and in-service teachers (Albion, 2001; Henson, 2002; Paraskeva, Bouta & Papagianni, 2008). These studies have found that self-efficacy is a factor influencing teachers' abilities to use technologies in their teaching. For example, Albion's (2001) research investigating 89 pre-service teachers' self-efficacy and their computer use found a relationship between teachers' levels of self-efficacy and technology use. The amount of time that teachers spent using computers also significantly affected their self-efficacy (Albion, 2001). This idea is supported by Bauer and Kenton's (2005) and Paraskeva, Bouta and Papagianni's (2008) research. Bauer and Kenton's (2015) study highlighted that some teachers felt that their limited expertise with computer technology was a barrier to successful technology integration. Paraskeva, Bouta and Papagianni's (2008) research on 286 in-service teachers found a positive relationship existed between teachers' content area, prior computer experience and computer self-efficacy.

Several studies on teacher self-efficacy have focused on pre-service and in-service teachers' use of technologies in teaching and the impact of professional development (Giles & Kent, 2016; Lin & Zheng, 2015; Robertson & Al-Zahrani, 2012). For example, findings from Lin and Zheng's (2015) research highlighted that teachers wanted to engage in more professional development, specifically in relation to transitioning from a face-to-face to an online teaching and learning environment. Robertson and Al-Zahrani's (2012) study investigating 325 pre-service teachers found 'that pre-service teacher access, training, and exposure to computers and ICTs will contribute effectively to boosting their self-efficacy, motivation, and computing habits' (p. 1136).

Empirical research has addressed the relationship between pre-service teacher's self-efficacy and observations of others on technology use in teaching (Al-Awidi & Alghazo, 2012; Wang, Ertmer & Newby, 2004). Al-Awidi and Alghazo's (2012) research investigating 73 pre-service elementary teachers found that their teaching experiences greatly affected their self-efficacy when integrating technology into teaching. The two factors with the strongest effect on their self-efficacy were mastery and vicarious experiences. This research showed differences in before and after teaching experiences and concluded that it was beneficial that pre-service teachers observe teachers who displayed positive self-efficacy when integrating technology into teaching.

In addition to research undertaken on pre-service and in-service teachers, research on university teachers' self-efficacy and technology use has been undertaken in higher education (Horvitz, Beach, Anderson & Xia, 2015; Robinia & Anderson, 2010). Most of the research has used quantitative methods where a large number of participants respond to scales or surveys (e.g. Horvitz, Beach, Anderson & Xia, 2015; Robinia & Anderson, 2010). However, a smaller number of studies have focused on qualitative methods, such as case studies, to better understand university teachers' self-efficacy and technology use

(e.g. Jokinen & Mikkonen, 2013). Overall, research in this area has focused on teacher self-efficacy and adoption of technology in teaching and measuring university teachers' self-efficacy in relation to technology use.

Several studies have addressed university teachers' self-efficacy and the adoption of technology in teaching. For example, Kim and Kim's (2013) research on university teachers' adoption of technology in teaching found that teachers' perceived levels of self-efficacy had an impact on decisions to adopt and use technologies in their teaching. Research has shown that both low and high levels of self-efficacy can influence how technology is adopted into practice (Compeau & Higgins, 1995). Barriers to technology integration include university teachers not having the necessary skills (Bhati, Mercer, Rankin & Thomas, 2009) and issues around professional development (e.g. Rienties, Brouwer & Lygo-Baker, 2013). Research by Schneckenberg (2009) showed that current continuous professional-development interventions are generally ineffective in increasing teachers' technology use.

Research has used several different surveys and scales to measure university teachers' self-efficacy and technology use. For example, Robinia and Anderson's (2010) research explored 140 university teachers working in a nursing faculty. A 32-item instrument was designed to measure these teachers' online self-efficacy. The findings showed that teachers' levels of self-efficacy increased after they completed teaching of three online courses. In addition, Horvitz, Beach, Anderson and Xia's (2015) research measured 345 university teachers' self-efficacy using a survey, finding that university teachers had high levels of self-efficacy. Variables influencing self-efficacy were found to be student learning, experience teaching online, future interest teaching online, gender, academic discipline and satisfaction teaching online. For example, improvements in student learning led to an increase in the instructor's self-efficacy for online learning. As stated by Horvitz, Beach, Anderson and Xia (2015, p.13) 'the variables that most highly impact teachers' online teaching self-efficacy are those that are internal to online teachers: perception of student learning and satisfaction with online teaching, as well as future interest in teaching online'. Their research showed that these variables can be developed through faculty training and additional support structures and 'early support for new online instructors should focus on benefits to students, best practices that yield student interaction, and ideas about course management that are simple to implement in early course attempts. Later training can deepen and broaden instructional practices and computer skills' (Horvitz, Beach, Anderson and Xia (2015, p.14).

Table 2.4 – Variables influencing an instructor's self-efficacy in the transition to online teaching (Horvitz, Beach, Anderson & Xia, 2015)

Variable(s)	**Influence of variable**
Student learning: perceptions of learning and future interest	'Perception of learning (participant's perception of the amount their students learned in their online courses) was found to be a significant predictor of three of the four efficacy sub-scales (all except use of computers). This relationship corresponded with one of the four influences on self-efficacy described by Bandura (1997), that is, mastery experiences. Mastery experiences are actual teaching accomplishments in which teachers witness student performance improvement. Intuitively, it makes sense that an instructor who perceives that students are learning a great deal gains confidence in his/her ability to engage students in an online course; it would be surprising if they did not. This could be interpreted as emphasizing the critical nature of putting online instructors in positions to succeed through the provision of adequate resources and support when they are teaching online the first few times' (Horvitz, Beach, Anderson & Xia, 2015, p.11). 'Future interest in teaching online was also found to be a significant predictor of overall self efficacy in online student engagement, but satisfaction with teaching online was not. Also, this was the only sub-scale for which future interest was a significant predictor' (Horvitz, Beach, Anderson & Xia, 2015, p.11).
Gender	'Women in this study were found to have higher self-efficacy in online instructional strategies than men' (Horvitz, Beach, Anderson & Xia, 2015, p.12).
Academic Discipline	'The variable discipline showed up as a significant predictor and appears to reflect preconceptions we might have about the technical skills of individuals in the professional fields versus those in the arts and humanities. At this institution, professors from the professional schools (Business, Education, Health, and Aviation) embraced online course offerings earlier and more readily than did those in Arts and Sciences and Humanities' (Horvitz, Beach, Anderson & Xia, 2015, p.11).

Below are three tables: the first summarises definitions associated with general self-efficacy and technology self-efficacy, the second addresses characteristics of high self-efficacy and the third focuses on characteristics associated with low self-efficacy.

Table 2.5 – Definitions of self-efficacy and technology/technological self-efficacy

Term	Definition
Self-efficacy	• Bandura (1977) described perceived self-efficacy as 'beliefs in one's capabilities to organise and execute the courses of action required to produce given attainments' (p. 3). • Self-efficacy is context specific and relates to a specific situation or task in a particular field (Kent & Giles, 2017; Zulkosky, 2009). • Self-efficacy beliefs impact behaviour, including decisions regarding course of action, amount of effort for a task and emotional responses or reactions about successes (Bandura, 1997, p. 3). • Bandura (1997) described four primary influences on self-efficacy beliefs: (1) mastery experiences, (2) vicarious experiences, (3) social influences/persuasions, and (4) physiological states/factors. Amongst these four influences, 'mastery experiences generally have the strongest effect on self-efficacy development, because [these experiences] are the most authentic indicators of one's capabilities' (Pritzner-Eden, 2016, p.2) • In general, it is expected that higher self-efficacy beliefs will positively support action, whilst lower self-efficacy beliefs can impact decisions about action (Abbitt, 2011)
Technology/ technological self-efficacy	• Technology self-efficacy refers to one's beliefs in their ability to use technology or technological tools successfully in a particular situation (Barton & Dexter, 2019; McDonald & Siegall, 1992). This specific construct focused on describing general feelings toward the use of technology and thus, is applicable to numerous technologies and/or technological tools. • Like general self-efficacy, technology self-efficacy is also context specific. • Technology self-efficacy is a broad term that covers a range of constructs, such as computer self-efficacy (Compeau & Higgins, 1995; Faseyitian, Libii & Hirschbuhl, 1996; Olivier & Shapiro, 1993) and internet self-efficacy (Joo, Bong & Choi, 2000).

Table 2.6 - Characteristics of high self-efficacy

Characteristic	Source	Example/scenario
Set challenging goals, commit to challenges and strive to meet their goals	Miller, Headings, Peyrot and Nagaraja (2011) Zulkosky (2009)	'The more capable people believe themselves to be, the more confident they are that goals can be attained, the more firmly committed they remain and the more positively they respond to negative feedback' (pp.2-3). 'They achieve these goals by visualising successful outcomes instead of dwelling on the potential negative consequences' (p.96).
Manage potential threats and lower their stress and anxiety	Horvitz, Beach, Anderson and Xia (2015) Zulkosky (2009)	An individual 'with high self-efficacy, when facing negative outome expectations, [will] more likely [be able] to make an effort to change their work environment and persist at their work' (p.5). An individual 'who believe[s] they can manage threats are less disturbed by them. They can lower their stress and anxiety by exercising control over the potential threats' (p.96).

Experience repeated success at a task and feel less threated by minor setbacks	Zulkosky (2009)	'Once a person continues to be successful, a robust feeling of self-efficacy develops and [this person is] less troubled by minor setbacks. Any failures for this person are viewed as a lack of effort and another attempt is made to become successful' (p.97).
See others succeed and feel that they can succeed too	Kent and Giles (2017)	A teacher 'who observe[s] experienced teachers … successfully integrate technology into learning are more likely to have an increased sense of self-efficacy' (p.36).
Practice completing a task with success and gain experience	Kent and Giles (2017) Abbitt (2011) and Bandura (1997)	'Successful experiences with instructional technology, as a preservice teacher, leads to positive efficacy, thus resulting in an increased probability that technology will be used as a teaching tool' (p.36). When a 'person experiences success [this] will lead to [an] increased self-efficacy. Provided that these experiences are in an authentic environment and the task requires overcoming obstacles through perseverant effort' (p.136).
Facilitates cognitive processes and performance	Zulkosky (2009)	'A strong sense of self-efficacy facilitates cognitive processes and performance in a variety of settings, including quality of decision making and academic achievement' (p.94).

Table 2.7 - Characteristics of low self-efficacy

Characteristic	**Source**	**Example/scenario**
Doubt their capabilities and experience anxiety	Horvitz, Beach, Anderson and Xia (2014)	An individual 'with low self-efficacy were more likely to have feelings of hopelessness and [be] less likely to persist in similar situations' (p.5).
Pessimistic about their developments and accomplishments	Zulkosky (2009)	'A low sense of self-efficacy is associated with stress, depression, anxiety and helplessness. Such individuals also have low self-esteem and become pessimistic about their accomplishemnts and personal development' (p.94).
Experience failure, hindering their decisions and beliefs in themselves to succeed	Abbitt (2011) Zulkosky (2009)	'Failures in an authentic environment are likely to decrease self-efficacy beliefs' (p.136). 'Failure in tasks fosters a low level of self-efficacy' (p.96).
Avoid innovation and complex tasks, instead relying on basic and simple activities	Taylor and Wilson (2019)	'With low self-efficacy people are less likely to engage in complex tasks or are more likely to give up quickly' (p.2).

In sum, although teacher's self-efficacy for technology use has been explored in higher education, a more in-depth investigation drawing on qualitative methods is required. To investigate this gap, an in-depth, exploratory investigation will be undertaken to determine how the sources of self-efficacy influence university teachers' technology integration.

2.4.1.3 Value and its influence on technology integration in higher education

Value has been found to have an influence on university teachers' technology use in teaching. Research into the value that teachers place on technology use has been explored in schools, with a smaller body of literature available on the value university teachers place on technology integration. Research focusing on school teachers has shown that teachers must see the relevance of technology to their specific discipline, and that availability of technologies does not always equate to use in practice (Kale & Akcaoglu, 2017). Research examining university teachers has specifically focused on the adoption of technologies in teaching, as well as barriers to adoption (Ajjan & Hartshorne, 2008).

Expectancy-Value Theory, developed by John William Atkinson (1957) and later expanded upon by Jacquelynne Eccles and colleagues, focuses on the achievement motivation of individuals (Eccles et al, 1983; Eccles, 1987). This conceptual framework provides insight into how value can influence an individual's decision to use technologies in their teaching. To explore the factor of value and its influence on technology integration, this section will provide a description of Expectancy-Value Theory and address empirical evidence.

2.4.1.3.1 Expectancy-Value Theory

In the 1960s, John Atkinson studied the psychology of motivation and achievement (Atkinson, 1957). His work focused on how behaviour could be affected by motives, specifically the probability of success and incentive value. Atkinson's work was expanded upon in the 1980s by Jacquelynne Eccles and colleagues (Eccles et al. 1983). Their research, grounded in the field of education, outlined that a student's achievement and achievement-related decisions are influenced by two factors: expectancies for success and subjective task values. Expectancies for success are the beliefs an individual has about their success on particular tasks. These beliefs are said to have an influence on decisions and behaviours, and are connected to self-efficacy and self-concept. Subjective task values are an individual's motivation to complete a certain task and why they would undertake the task. Subjective task values can be divided into four categories: attainment value, intrinsic value, utility value and cost. First, attainment value 'is the personal importance of doing well on a task' (Eccles et al., 1983, p. 119). Second, intrinsic value is the

‘enjoyment the individual gets from performing the activity’ (Eccles et al., 1983, p. 120). Third, utility value is ‘determined by how well a task relates to current and future goals, such as career goals (Eccles et al., 1983, p. 120). Fourth, cost is ‘the negative aspects of engaging in the task (Eccles et al., 1983, p. 120).

The value teachers place on technology use has been examined in schools. Research has found that even though there is an abundance of technological resources available, teachers do not necessarily alter their teaching practices to innovatively use technologies in their teaching. For example, Shifflet and Weibacher (2015) used a case-study approach to examine the actions and attitudes of 13-year veteran social-science teachers, finding that even though teachers felt that technology could be used to engage students in critical thinking and the development of literacy skills, they did not always use technologies in their actual practice. Although teachers are drivers for change, Howard (2013) highlighted that a lack of leadership and technical and pedagogical support can have an effective on the value that teachers place on using technology. Howard (2013) also pointed out that teachers must see how technology is relevant to their teaching of a specific discipline area and how it aligns with learning goals, as without clear expectations for technology use and a lack of value, teachers are less likely to take risks in using technology in their teaching.

Empirical research on the value that university teachers place on technology use in teaching is limited. In higher education, this research has addressed the adoption of technologies in teaching and the potential barriers influencing the adoption process. For example, research undertaken by Ajjan and Hartshorne (2008) explored why university teachers are hesitant to adopt Web 2.0 tools for teaching and learning, finding that although some faculty members saw the benefits of using Web 2.0 technologies to improve student learning, only a few used these technologies in their classroom. This study is supported by research that investigated whether university teachers valued Facebook in their classroom (Roblyer et al., 2010). Findings from this study highlighted that students were more open to the use of Facebook and similar technologies in the classroom, whereas faculty members preferred the use of more-traditional teaching methods, such as email. This research, however, has been challenged by a more recent study that explored the use of social media by university teachers. This research showed that the majority of participants believed that video, podcasts, and wikis are important tools for teaching, and that social-media sites are valuable for collaborative learning (Moran, Seaman & Tinti-Kane, 2011). In summary, research in the area of value and technology use in higher education is limited. Research does exist on the value university teachers place on using specific technologies in their teaching. However, this limitation provides the opportunity to extend research in this area.

Table 2.8 - Characteristics of high value

Characteristic	Source	Example/scenario
Makes tasks relevant	Green (2002)	An individual emphasises the importance of making tasks personally relevant. Tasks can be made meaningful by addressing connections to the real-world or students' interests and concerns.
Selecting tasks focused on learning objectives	Green (2002)	An individual selects 'tasks with worthwhile academic objectives in mind' (p. 1001).

Table 2.9 - Characteristics of low value

Characteristic	Source	Example/scenario
Avoids considering the relevance of the task	Green (2002)	The individual does not emphasises the importance of making tasks personally relevant. Tasks can be made meaningful by addressing connections to the real-world or students' interests and concerns.
Avoids selecting tasks focused on learning objectives	Green (2002)	The individual does not select tasks with worthwhile academic objectives in mind.

In sum, research exploring university teachers' technology value is limited. There is a need to further investigate the influence of this factor on technology use to see whether additional research supports the ideas presented above. Eccles's Expectancy-Value Theory has been chosen as a theoretical construct guiding this investigation, however, only the model's subjective task values (attainment value, intrinsic value, utility value and cost) will be explored in this research.

2.5 Relationship between knowledge, self-efficacy and value

The above research has provided insights into three factors that influence university teachers' technology integration in teaching: knowledge, self-efficacy and technology value. To date, no research has investigated university teachers' technology use in teaching by drawing on Mishra and Koehler's TPCK Framework, Bandura's Theory of Self-Efficacy and Eccles et al.'s Expectancy-Value Theory in a single study. However, there is some research on pre-service and in-service teachers that explores the relationship between teachers' TPCK and self-efficacy (e.g. Canbazoglu Bilici et al., 2013; Lee & Tsai, 2010; Pornsook & Praweenya, 2013). Lee and Tsai's (2010) study of 588 teachers from elementary and secondary schools in Taiwan investigated teachers' perceived self-efficacy regarding their TPCK about the Web and associated technologies (TPCK-W). The study highlighted that a relationship existed between teachers' self-efficacy and positive attitudes towards web-based instruction. Further, older and more-experienced teachers reported that they had lower levels of self-efficacy regarding their TPCK-W, whilst teachers who had experience using the web were found to have higher levels of self-efficacy in relation to their TPCK-W. Research by Canbazoglu Bilici et al. (2013) explored 808 senior pre-service

science teachers' self-efficacy beliefs towards TPCK using the TPaCK Self-Efficacy scale, finding that this scale was a valuable tool for teachers, educators and researchers in evaluating pre-service science teachers' self-efficacy beliefs towards TPCK.

Like self-efficacy, Expectancy-Value Theory addresses an individual's motivation in a specific context. The inclusion of Expectancy-Value Theory in this research is because it focuses on 'why' a decision to adopt technology is made. When an individual is faced with a new task, they may ask themselves whether they can perform the task (self-efficacy) and why they should undertake the task (task-value). Research undertaken on 797 secondary students has found that 'students' expectancy-value beliefs played a mediator role between academic self-efficacy and the achievement/satisfaction relationship' (Domenech-Betoret, Abellan-Rosello & Gomez-Artiga, 2017, p.1). In addition, other research has also explored the relationship between both constructs, specifically self-efficacy being a predictor of task-value (e.g. Azar et. At, 2010; Keskin, 2014). Whilst research is available on Expectancy-Value theory and students' academic achievement, research on Expectancy-Value theory and university teachers' decisions to adopt technology in teaching is limited. Thus, in addition to knowledge, this research draws upon two motivational frameworks (Self-Efficacy Theory and Expectancy-Value Theory). Whilst the inclusion of both models can be critiqued, as Expectancy-Value Theory also addresses expectancies for success, Bandura's construct of self-efficacy has received more attention in the area of university teachers' technology integration and thus, both frameworks guide this investigation.

2.5.1 Gaps in the literature

There is an expectation that university teachers will integrate technologies into their teaching to enhance student learning. Higher-education institutions have made efforts to encourage the use of various online approaches, such as blended learning, and have provided teachers with access to technologies that they can use in face-to-face teaching. Prior research has shown that a number of technology-based tools such as laptops, data projectors, interactive whiteboards, desktop computers, video conferencing equipment, eLearning systems and email facilities are available to university teachers (Appana, 2008; Jamil & Shah, 2011; Renes & Strange, 2011; Zhao, Alexander, Perreault, Waldman & Truell, 2009). However, regardless of the availability of these resources and the affordances of technology to teaching, teachers' technology integration varies. Through a review of the literature, three factors have been found to influence university teachers' technology use in teaching: knowledge, self-efficacy and technology value (e.g. Benson & Ward, 2013; Chen, Liao, Chang, Hung & Chang, 2019; Khan, 2011; Mishra & Yayha, 2007; Horvitz, Beach, Anderson & Xia, 2015; Robinson & Anderson 2010; Ajjan & Hartshorne, 2008).

To date, there is no research investigating university teachers' technology integration in teaching using Mishra and Koehler's (2006) TPCK Framework, Bandura's (1977) Theory of Self-Efficacy and Eccles's (1980) Expectancy-Value Theory. Instead, previous research has mainly explored the three factors

independently, with a smaller number of studies combining two of these factors (e.g. Canbazoglu Bilici et al., 2013; Lee & Tsai, 2010; Pornsook & Praweenya, 2013). This research has also largely focused on pre-service and in-service teachers, and a number of studies have used quantitative methods, such as surveys, and questionnaires. These gaps, therefore, provide the opportunity to extend the insights of previous literature by exploring the influence of all three factors in a single study on university teachers' technology integration in teaching. Given that a number of previous studies have employed quantitative methodologies, this research will use a qualitative research approach.

The current study addresses an important problem in higher education: why are there variations in university teachers' technology integration in teaching? This is an important problem to explore, as research has shown the positive influences of technology use on student learning (Gorra & Bhati, 2016; Miniaoui & Kaur, 2014). The current research, therefore, advances knowledge in the field by providing a comprehensive, holistic view of teachers' technology integration by drawing on three theoretical constructs in a single study. Exploring a more comprehensive framework for teachers' technology integration can improve understanding about the contextual factors that enable or constrain technology integration in teaching.

From reviewing the literature on TPCK, self-efficacy and Expectancy-Value Theory, Figure 2.4 presents a framework that integrates the three theoretical constructs. It explains the relationship between these constructs and how collectively they can influence technology integration in a specific context. Literature investigating TPCK, self-efficacy and technology value show that tasks or activities are context-specific and relate to a specific situation in a particular field. Thus, context has been highlighted as a central feature of the model.

Four key contextual factors presented in the model that influence university teachers' technology integration are institutional factors (e.g. policy and curriculum), student dynamics, support (e.g. professional development opportunites) and instructional design (Al-RSA, 2012; Bhati, Mercer, Rankin & Thomas, 2009; Chen, Liao, Chang, Hung & Chang, 2019; Horvitz, Beach Anderson & Xia, 2015; Matheos, 2010; Rienties, Brouwer & Lygo-Baker, 2013). The individual is placed at the centre of this model and it is proposed that all three constructs (knowledge, self-efficacy and technology value) have an influence on one's choices and decisions regarding technology use in teaching. Whilst the exact influence of each construct is unknown, the construction of the model has been guided by the findings of the literature.

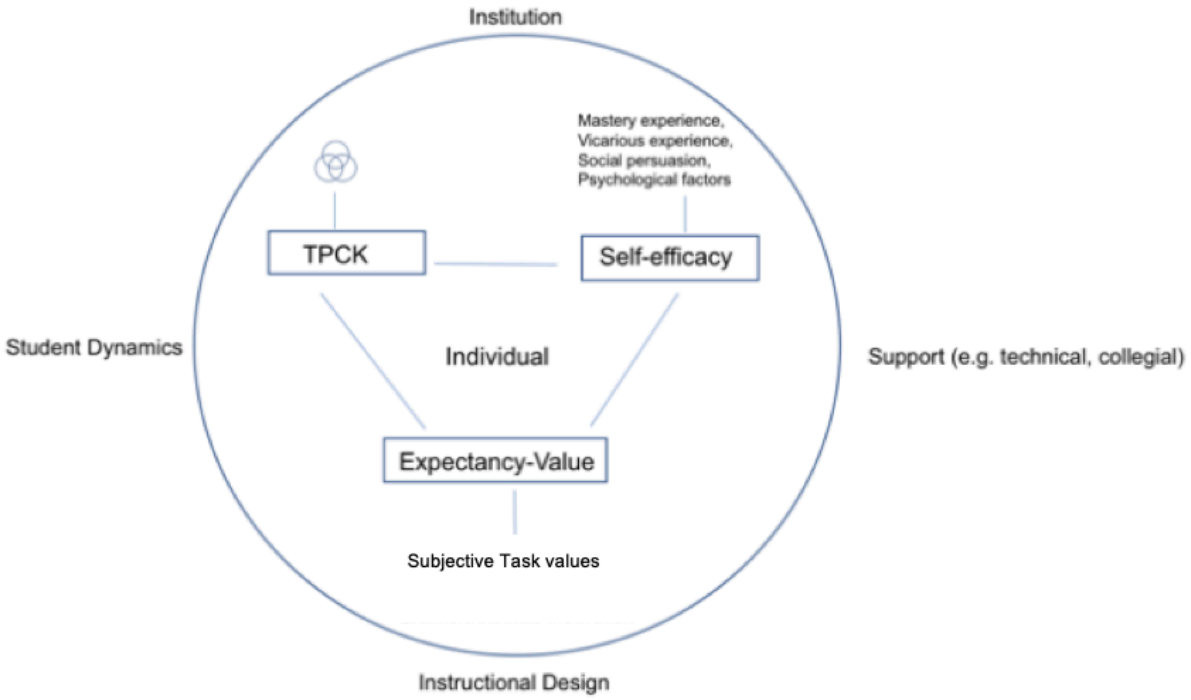
The proposed model incorporates the TPCK framework by Mishra and Koehler. Through including this theoretical construct, the researcher acknowledges that successful technology integration relies on combining three knowledge forms (TPCK): technology, pedagogy and content. The model also draws on

Bandura's Self-Efficacy Theory and notes the four key sources influencing one's self-efficacy: mastery experiences, vicarious experiences, social persuasion and physiology factors.

A relationship between TPCK and self-efficacy is also suggested in the model. The model aims to address how knowledge in TPCK domains can influence self-efficacy beliefs about technology use and this relationship can evolve within a specific context (Abbitt, 2011). As one enhances their knowledge or understanding of the complex relationship between knowledge, content and pedagogy, this can lead to developing an individual's self-efficacy over time. Thus, this relationship has been addressed in the model.

The proposed model highlights that a sound knowledge base as well as a strong self-efficacy are not enough to drive meaningful technology use. Thus, Expectancy-Value Theory has been included in Figure 2.4 and focuses on the influence of subjective task values on technology integration. The subjective task values that are included in the proposed model as influencing the uptake of technology are utility value, attainment value, intrinsic value and cost. These influences are included in the framework to explain why one may or may not value technology in their teaching. It must be noted that whilst all potential influences for self-efficacy and expectancy-value have been identified in the framework, their impact within a given situation may vary or not be applicable depending on the individual and their experiences.

Figure 2.4 – Framework integrating theoretical constructs: TPCK, self-efficacy and value



2.6 Chapter summary

This chapter has provided a critical review of the three factors influencing university teacher's technology use in teaching. Within this chapter, the problem of the study was explored through a review of current literature and empirical evidence on knowledge, self-efficacy and technology value in the area of technology integration in teaching and learning. The chapter ends by outlining the main findings of the reviewed literature. It highlights gaps evident from this review and provides a detailed description of how the current study addresses these gaps.

Chapter 3
Research Methodology

3.1 Introduction

This chapter outlines the methodology used to explore the influences of knowledge, self-efficacy and technology value on university teachers' technology use in teaching. The chapter begins with a description of the qualitative research paradigm and case-study design. Following this is an explanation of the conceptual framework, the research question and methodological procedures (including ethical protocols), the selection of case study participants, data-collection instruments and data-analysis strategies. Issues of credibility are then presented, and the chapter is concluded.

3.2 A qualitative approach

The investigation of university teachers' technology integration in higher education is located within a qualitative research paradigm. This paradigm allows context to be considered in the understanding of a phenomenon and explores the experiences and perspectives of participants through the examination of multiple data sources (Denzin & Lincoln, 2005, 2018). This approach was important for this study because it allowed the researcher to study the participants in their natural setting, with the aim of understanding and interpreting phenomena from their perspective. Within this inquiry, a case-study research methodology was chosen to investigate university teachers' technology use in different academic contexts (Merriam, 1998; Stake, 1995).

The investigation 'occur[red] in a natural setting rather than an artificially constrained one such as an experiment' (Marshall & Rossman, 1989, p.10). A quantitative research paradigm was not selected for this type of investigation, as its purpose is to control or manipulate an issue rather than understand the problem and what is happening in a natural setting. Thus, this research focused on multiple understandings of what is considered worthwhile knowledge, aligning with a qualitative research approach. Qualitative research is defined in the literature as:

> 'The systematic inquiry into social phenomena in natural settings. These phenomena can include, but are not limited to, how people experience aspects of their lives, how individuals and/or groups behave, how organi[s]ations function, and how interactions shape relationships. In qualitative research, the researcher is the main data collection instrument. The researcher examines why events occur, what happens, and what those events mean to the participants studied' (Teherani, Martimianakis, Stenfors-Hayes, Wadhwa & Varpio, 2015, p.669).

> ‘Qualitative research is a situated activity that locates the observer in the world. It consists of a set of interpretive, material practices that make the world visible. These practices transform the world. They turn the world into a series of representations, including field notes, interviews, conversations, photographs, recordings and memos to the self. At this level, qualitative research involves an interpretive, naturalistic approach to the world. This means that qualitative researchers study things in their natural settings, attempting to make sense of or to interpret phenomena in terms of the meaning people bring to them’ (Mertens, 2020).
>
> ‘Qualitative inquiry, which focuses on meaning in context, requires a data collection instrument that is sensitive to underlying meaning when gathering and interpreting data. Humans are best suited for this task, especially because interview, observing and analysing are activities central to qualitative research’ (Merriam, 2009, p.2)
>
> ‘Qualitative research is an approach for exploring and understanding the meaning individuals or groups ascribe to a social or human proble. The process of research involves emerging questions and procedures, date typically collected in the participant’s setting, analysis inductively building from particulars to general themes, and the researcher making interpretations of the meaning of the data. The final written report has a flexible structure. Those who engage in this form of inquiry support a way of looking at research that honours an inductive style, a focus on meaning, and the importance of rendering the complexity of a situation’ (Creswell, 2013).

Through analysing the above excerpts, it can be concluded that the qualitative research design provides an in-depth investigation of a specific program, practice or setting, alluding to the important role of context in the qualitative research process. The researcher’s focus is on making sense of the meaning brought by others typically through three main methods for data collection: observations, interviews and artefacts. Thus, it is for these reasons that the qualitative research paradigm was chosen for this study: it focuses on interpretative practices and allows for the construction of ‘complex and encompassing perspectives’ (Creswell, 2003, p.182) through the collection and analysis of multiple data sources.

Below is a table (Table 3.1) that places the research methodology of this investigation within the qualitative research literature. When undertaking an investigation, it is important for researchers to consider their philosophical assumptions and how they underpin their research, specifically their research design and their research methods (Creswell, 2013). Each researcher brings their own way of viewing the world or set of beliefs (Denzin & Lincoln, 2000). As presented below, the constructivist paradigm is most appropriate for this qualitative research investigation as it acknowledged the complex nature of the phenonemom being studied and used an interpretive process to capture each participant’s understandings, ultimately highlighting that participants construct their own perspectives of reality.

Table 3.1 – Situating the research study within the qualitative research literature - Adapted from Agostinho (2005)

Perspective of the process of inquiry	Explanation/Rationale	The research study
Paradigm *The philosophical beliefs underpinning this research*	The qualitative researcher undertakes an investigation with a certain view of the world or set of beliefs. These beliefs relate to: • the nature of reality (ontology); • the nature of knowledge and the relationship between the researcher and research (epistemology); • the nature of ethics or ethical behaviour (axiology), and; • the research process, which involves the ways in which the researcher obtains knowledge and understandings (methodology)	The constructivist label was chosen for this research study. This approach highlights how individuals 'construct meanings as they engage with the world, they are interpreting… [It is the role of] qualitative researchers to understand the context or setting of the participants through visting this context and gathering information personally' (Creswell, 2013, p. 37). The researcher's worldview closely aligns with the constructivist worldview, and furthermore, they believe that research is largely inducive with a focus on generating meaning from the data collected. Basic beliefs associated with the contructivist inquiry that align with this research study are: **Ontology:** ''Construct meaning from engaging in the world; there are multiple realities' **Epistemology:** 'Interactive link between research and participants, values are made explicit; created findings' **Axiology:** 'Balanced representation of views' **Methodology:** 'Qualitative (primarily), hermeneutical, dialectical; contextual factors are described'
Strategy	'A strategy of inquiry comprises a bundle of skills, assumptions, and practices that researchers employ as they move from their paradigm to the empirical world. Strategies of inquiry put paradigms of interpretation into motion' (Denzin & Lincoln, 1994, p.14).	Case study (collective)
Data collection and analysis	'Strategies of inquiry connect the researcher to specific methods of collecting and analyzing empirical materials' (Denzin & Lincoln, 1994, p.14).	**Data collection techniques**: interviews and observations **Data analysis techniques**: data abstraction into themes and categories

In summary, as outlined in Table 3.1, this research is located within the qualitative paradigm and is underpinned by constructivisim. A collective case study approach was employed to provide an in-depth account of how and why teachers integrate technologies into their teaching. An analysis of seven cases was undertaken to report the outcomes of the study. The researcher maintained a personal and

interactive role during data collection, and participants shared their understandings and insights. Multiple forms of data were explored to triangulate the findings of this study, and the researcher engaged in reflective practices to describe possible subjectivity related to their role as the primary instrument for data collection. Data analysis focused on the identification of themes and themes were organised into categories. Through selecting a qualitative research paradigm, an exploratory approach was used to investigate a research problem where context is important, variables are unknown, and theory still requires development.

3.3 Case-study design

A case-study approach focuses on an in-depth investigation and examination of a single setting, subject or event. A case is consistently defined as 'a phenomenon of some sort occurring in a bounded context' (Miles & Huberman, 1994, p.25), or 'a thing, a single entity, a unit around which there are boundaries' (Merriam, 1998, p.27). In educational research, three prominent case-study methodologists are Robert Yin, Sharan Merrian and Robert Stake (Merriam, 1998; Stake, 1995; Yazan, 2015; Yin, 2002). These methodologists have varying views and conceptualisations of case-study research. Below, in Table 3.2, is a comparison of their work, with a focus on how their views complement, overlap and differ from one another. Multiple aspects of case-study design are presented for comparison, such as epistemological commitments, definitions and designs of case-study research and views on data collection, data analysis and validation strategies.

Table 3.2 – Juxtaposition of three case-study approaches (extracted from Yazan, 2015)

Dimension of interest	**Robert Yin's *Case Study Research: Design and Methods***	**Robert Stake's *The Art of Case Study Research***	**Sharam Merriam's *Qualitative Research and Case Study Applications in Education***
Epistemological Commitments	Positivism	Constructivism and existentialism (non-determinism)	Constructivism
Definiting Case and Case Study	**Case** is "a contemporary phenomenon within its real-life context, especially when the boundaries between a phenomenon and context are not clear and the researcher has little control over the phenomenon and context" (p. 13). **Case study** is an empirical inquiry that investigates the case or cases conforming to the	**Case** is "a specific, a complex, functioning thing," more specifically "an integrated system" which "has a boundary and working parts" and purposive (in social sciences and human services) (p. 2). **Qualitative case study** is a "study of the particularity and complexity of a single case, coming to understand its activity within important circumstances" (p. xi).	Case is 'a thing, a single entity, a unit around which there are boundaries' (p.27) and it can be a person, a program, a group, a specific policy and so on. Qualitative case study is "an intensive, holistic description and analysis of a bounded phenomenon such as a program, an institution, a person, a process, or a social unit' (p. xiii). Defining characteristics

	abovementioned definition by addressing the "how" or "why" questions concerning the phenomenon of interest.	**Defining characteristics:** *Holistic* (considering the interrelationship between the phenomenon and its contexts); *Empirical* (basing the study on their observations in the field); *Interpretive* (resting upon their intuition and see research basically as a researcher-subject interaction); *Emphatic* (reflecting the vicarious experiences of the subjects in an emic perspective).	Particularistic (focusing on particular situation, event, program or phenomenon); descriptive (yielding a rich, thick description of the phenomenon under study); heuristic (illuminating the reader's understanding of phenomenon under study).
Designing Case Study	Design refers to "the logical sequence that connects the empirical data to a study's initial research questions and, ultimately, to its conclusions" (p. 20). **Four types** of case study design include single holistic design, single embedded design, multiple holistic design, and multiple embedded design. Case study design has **five components**: a study's questions; its propositions, if any; its unit(s) of analysis; the logic linking the data to the propositions; and the criteria for interpreting the findings. Quantitative and qualitative evidentiary sources should be combined.	Flexible design which allows researchers to make major changes even after they proceed from design to research. Researchers need a set of two or three sharpened issue questions (research questions) that will "help structure the observation, interviews, and document review" (p. 20). He relies on Parlett and Hamilton's (1972) notion of "progressive focusing" which builds upon the assumption that "the course of the study cannot be charted in advance" (cited in Stake, 1998, p. 22). Exclusive use of qualitative data sources.	Literature review is an essential phase contributing to theory development and research design. Theoretical framework emerging from literature review helps mold research questions and points of emphasis. **Five steps of research design**: conducting literature review, constructing a theoretical framework, identifying a research problem, crafting and sharpening research questions, and selecting the sample (purposive sampling).
Gathering Data	Data gathering is influenced by case study investigator's skills, training for a specific case study, the development of a protocol for the investigation, the screening of the case study nominations (making the final decision regarding the selection of the case), and the conduct of a pilot study. Case study researchers make use of six data gathering tools: **documentation, archival**	Being a qualitative case study researcher requires "Knowing what leads to significant understanding, recognizing good sources of data, and consciously and unconsciously testing out the veracity of their eyes and robustness of their interpretations. It requires sensitivity and skepticism" (Stake, 1995, p. 50). Qualitative case study researchers exploit **observation, interview and document review** as data gathering tools.	Exclusive use of qualitative data sources. Qualitative case study researcher needs to acquire the necessary skills and follow certain procedures to conduct effective interviews and careful observations and mine data from documents. Qualitative case study researchers utilize three data collection techniques conducting **interviews, observing, and analyzing documents**.

	records, interviews, direct observations, participant observation and physical artifacts.		
Analysing data	Data analysis "consists of examining, categorizing, tabulating, testing, or otherwise recombining both quantitative and qualitative evidence to address the initial propositions of a study" (p. 109). **Five dominant techniques for data analysis**: pattern matching, explanation building, time-series analysis, program logic models, and cross-case synthesis.	Data analysis is "a matter of giving meaning to first impressions as well as to final compilations" (p. 71). Simultaneity of data collection and analysis. **Two strategic ways to analyze data**: Categorical Aggregation and Direct Interpretation. "Each researcher needs, through experience and reflection, to find the forms of analysis that work for him or her" (p. 77).	Data analysis is "the process of making sense out of the data... [which] involves consolidating, reducing, and interpreting what people have said and what the researcher has seen and read – it is the process of making meaning" (p. 178). Simultaneity of data collection and analysis. **Six analytic strategies**: ethnographic analysis, narrative analysis, phenomenological analysis, constant comparative method, content analysis, and analytic induction.
Validating Data	Case study researchers need to guarantee **construct validity** (through the triangulation of multiple sources of evidence, chains of evidence, and member checking), **internal validity** (through the use of established analytic techniques such as pattern matching), **external validity** (through analytic generalization), and **reliability** (through case study protocols and databases).	Issues of data validation are involved in the notion of triangulation. **Four strategies for triangulation**: data source triangulation, investigator triangulation, theory triangulation, and methodological triangulation.	Qualitative methodology approaches differently to validity and reliability of the knowledge produced in research. **Six strategies to enhance internal validity**: triangulation, member checks, long-term observation, peer examination, participatory research, and disclosure of researcher bias. **Three techniques to ensure reliability**: explanation of investigator's position with regards to the study, triangulation, and use of an audit trail. **Three techniques to enhance external validity**: use of thick description, typicality or modal categories, and multi-site designs.

Through analysing the above table, it is evident that the three methodologists have their own epistemological beliefs about case study methodology and how it should be approached by novice researchers (Merriam, 1998; Stake 1995; Yin, 2002). Yin's beliefs steer more toward a positivistic perspective where researchers should 'maximise four conditions related to design quality [throughout all stages of inquiry]: construct validity, internal validity, external validity, and reliability '(Yin, 2002, p.19). Stake and Merriam's epistemological beliefs, however, seem to be more closely aligned with constuctivist views and their focus is on how qualitative research allows for knowledge construction or meaning making (Yazan, 2015).

Variations between methodologists can also be seen in their definitions of case and case study (Yazan, 2015). From Yin's perspective, case study is an empirical inquiry where case(s) are investigated through 'how' and 'why' questions. There is a focus on consistency among design components and the phases of case study research. Yin believes that case study methods are suitable for program evalution, which overlap with Stake's views. Stake believes that his approach to case study research is better suited to study programs and people rather than events and processes. Similiarities between Stake and Merriam's views are also evident. Both methodologists saw a case as an integrated system; however, Merriam's work provided a more comprehensive list of what can be considered a case. The definition that Merriam provided shows more flexibility in the use of a qualitative case study strategy to explore a wider range of cases.

In regard to the design of case study, variations are seen among Yin, Stake and Merriam's work (Yazan, 2015). Yin provided a rigid, structured design for case study research, whilst Stake presented a more flexible approach allowing major changes to be made by researchers between the stages of design and research. Merriam's approach to case study design does not align with either Yin or Stake; however, it is a combination of both approaches. Merriam's work provided detailed step-by-step guidelines on how to design qualitative research and her discussion addresses conducting a literature review, developing a theoretical framework, crafting a research problem and selecting the sample. All three methodologies highlighted that researchers gather their data from multiple sources to understand the complexity of the case and explore it in its entirety. However, Yin, Stake and Merriam differed in the tools used to collect data. Yin focused on the use of both qualitative and quantitative data, whereas Stake and Merriam highlighted the collection of qualitative data only. The epistemological beliefs of the three methodologists appear to influence their approach to data analysis in case study (Yazan, 2015).

Whilst there is evidence of all three case study methodologies in this investigation, this research mostly aligns with Merriam's (1998) and Stake's (1995) approaches. Research guided by case study principles does not necessarily need to align with one specific approach; instead, case study research should be informed by the context of the study. For example, this research study aligns with what Stake terms collective case study. Collective case studies allow for the exploration of multiple cases at the same time, allowing similarities and differences to emerge and findings to be replicated. This study is well-suited to a

collective case study approach because it explores seven university teachers who each designed and delivered a single subject (undergraduate or postgraduate) in their natural setting. By using this approach, the researcher developed an in-depth understanding about complex relationships, as well as the participants' experiences within the setting to enable multiple realities to unfold (Cohen, Manion & Morrison, 2000; Lincoln & Guba, 1985). During this research study, all participants were followed for the course of one 13-week university semester to explore how they integrated technology into their teaching. A case study conducted over an extended period of time focuses on providing details about processes and contextual elements. Given that multiple participants were explored during one university semester, time can be identified as a limitation affecting how much depth could be provided for each case. However, given the problem investigated for this research, a collective case study was appropriate because it provided a more comprehensive understanding of university teachers' technology integration. Thus, through the use of a collective case study design, multiple perspectives were explored, and participants' experiences were compared and contrasted. These differing perspectives also provided an indication of how experience levels, age and academic context may influence technology integration.

In summary, the method of inquiry adopted for this research was case study because it provided an in-depth investigation of a system. Seven case studies were examined to advance understanding of a particular phenomenon through firstly describing and then reporting on the findings of the cases. A collective case study was chosen because it allowed several cases to be explored within a given period of time allowing multiple perspectives and experiences to emerge.

3.4 Conceptual framework

Within the collective case study approach, data collection and analysis were guided by a conceptual framework whereby three theoretical constructs were explored. The purpose of this study was to provide an in-depth examination of how and why university teachers integrate technologies into their teaching. A particular focus was on each university teacher's knowledge, self-efficacy and technology value and how these factors influenced technology use in different academic contexts. The three theoretical constructs explored were Mishra and Koehler's (2006) TPCK Framework, Bandura's (1977) Theory of Self-Efficacy and Eccles's (1980) Expectancy-Value Theory. TPCK was used to conceptualise the technological, pedagogical, content knowledge teachers possess and how these forms of knowledge interact to enable the effective integration of technology in teaching. Bandura's Theory of Self-Efficacy framed teachers' levels of self-efficacy when completing specific technology-based tasks. Eccles et al.'s (1983) Expectancy-Value Theory helped to account for the value that university teachers place on technology use in their teaching. The following section will provide a brief overview of each theory and describe how previous research has informed the methodology of this study.

3.4.1 Technological, pedagogical, content knowledge

Research into how knowledge influences university teachers' technology integration in specific academic contexts is limited (Benson & Ward, 2013; Koehler, Mishra & Yahya, 2007). Many studies exploring TPCK have addressed pre-service/in-service teachers and used quantitative methodologies, specifically in the form of self-reporting and assessment surveys or questionnaires (e.g. Jang & Tsai, 2012; Koh, Chai, Hong, & Tsai, 2015; Schmidt et al., 2009). These studies have used surveys or questionnaires to gain an understanding of teachers' technology use in relation to TPCK and to develop survey instruments for the purpose of measuring TPCK (Table 3.3). Although quantitative methods have been used to measure teachers' TPCK, some questions are difficult to answer through self-reporting surveys. As outlined by Bibi and Khan (2017) 'surveys restrict respondents to providing answers only to given questions, which eliminates the possibility of finding out how teachers draw on these knowledge domains in actual planning and teaching settings' (p. 72). Therefore, in response to this concern, this research has used a qualitative approach to explore university teachers' technology use in their teaching.

Table 3.3 – Review of quantitative research: TPCK

Research methodology	Research approach	Focus of research	Empirical evidence
Survey studies	Quantitative	Surveyed teachers' perceptions of design dispositions, lesson design practices and their relationship with TPCK	e.g. Koh, Chai, Hong and Tsai (2015)
Instrument validation	Quantitative	Developed surveys to measure the different domains of TPCK	e.g. Sahin (2011)

Qualitative approaches can provide insights into the experiences and perspectives of participants through an in-depth investigation of a phenomenon in context. A review of empirical research has shown that since 2011, observations of teachers in real-life settings have become more common when exploring university teachers' TPCK (Bibi, & Khan 2017; Markauskaite, Bachfischer, Goodyear & Kali, 2011). For example, Bibi and Khan's (2017) research used extensive observations to investigate a single case: a university lecturer with the pseudonym James. These observations provided an understanding about the ways in which James combined his TPCK when making real-life decisions about planning. Markauskaite, Bachfischer, Goodyear and Kali's (2011) research also used observations to investigate university teachers' design decisions. These observations showed that in the course of making these decisions, the teachers discovered new knowledge domains as a result of their interactions with TPCK. Examples of these domains included curriculum and availability of resources for learners. Thus, for the purpose of the research presented in this thesis, observations were useful in allowing the researcher to explore the participants' knowledge of TPCK in a real-life context and provided a more in-depth understanding of teachers' planning, design and classroom teaching (Tai & Crawford, 2014). In addition to the

observations, interview data were also collected for this research. Using TPCK to frame interview questions allowed the participants to share their perspectives around their own knowledge and further provide any detail that may not have been readily available through observations. TPCK was used to guide the design of interview questions in the interviews at both the beginning and end of the semester. For example, samples questions included: ‘How have you designed the subjects you teach?’, ‘How are you using technology in your teaching this semester?’ and ‘What role does your Moodle site play in your subject?’. Following data collection, TPCK was also used to assist the researcher with data analysis. Each knowledge area (T, P, C) and their interactions (TP, PC, TC, TCK, TPCK) were used as codes and data were analysed according to these codes.

3.4.2 Self-efficacy

Research into self-efficacy and technology use has been undertaken in a number of educational settings, such as schools and universities (Paraskeva, Bouta, & Papagianni, 2008; Teo & Koh, 2010). This research has shown that for teachers to embed technologies into their teaching they must first believe they are self-efficacious. Although research in higher education is available on teacher self-efficacy and technology use, this research has largely focused on pre-service teachers undertaking education programs (e.g. Kent & Giles, 2017; Kiili, Kauppinen, Coiro & Utriainen, 2016). Data collection has primarily occurred through surveys or questionnaires where participants rate their levels of self-efficacy when completing technology-based tasks. For example, Kent and Giles's (2017, p. 12) research collected data through a survey addressing preservice teachers' 'perceived self-efficacy of several specific aspects of technology integration'. Further, Kiili, Kauppinen, Coiro and Utriainen's (2016) research examined pre-service teachers' self-efficacy beliefs towards technology use through questionnaire items. Thus, given that these quantitative data-collection methods restrict teachers to specific questions, a qualitative research approach was used for this study to explore the influence of university teachers' self-efficacy when integrating technology into their teaching. Interview questions grounded in Social Cognitive Theory were developed to better understand teachers' experiences with technology and how their self-efficacy influenced their subject design. Sample interview questions included: 'Which technologies do you most regularly use in your teaching? Why?' and 'Do you experiment with technology? Do you feel comfortable experimenting?'. Self-efficacy theory was also used to guide data analysis, as codes specifically relating to this theory were developed and used to inform analysis.

3.4.3 Expectancy-Value Theory

Research on the value university teachers place on the use of technology in teaching is limited. A study in this area has shown that qualitative practices have been used to obtain data about participants' attitudes towards blended learning in higher education (Benson, Anderson & Ooms, 2011). The data were used to explore the participants' beliefs and provide a more in-depth understanding of their thinking. Thus, this study has informed the methodology of this research, as it has shown that qualitative practices move beyond simply obtaining statistical data to providing individual reasoning and thought in relation to a real-world context. Interview questions and observation protocols were guided by the Expectancy-Value Theory and further informed data analysis. Sample interview questions included: 'Do you think some technologies are more important to use in your teaching than others? Why?' and 'Do you think your teaching would be the same or different if you did not have access to technology? Why?'.

In sum, whilst knowledge, self-efficacy and technology value have been researched, they have not been combined in a single study exploring university teachers' technology integration. Although previous research (e.g. Jang & Tsai, 2012; Kent & Giles, 2017; Koh, Chai, Hong, & Tsai, 2015; Schmidt et al., 2009) has largely used quantitative methods to explore the influences of these factors on university teachers' integration of technology in their teaching, this research will draw on qualitative methods, such as interviews and observations, to understand the phenomenon in context and to explore the participants' perspectives and experiences.

3.5 Research question

This study was guided by the following research question:

In what ways does a university teacher's TPCK, self-efficacy, and value of technology integration influence their use of technology in their teaching?

3.6 Research procedures

The purpose of this methodology was to explore the influences of knowledge, self-efficacy and technology value on university teachers' technology integration in teaching and identify some of the emerging relationships between these constructs. Data were collected from seven participants who each taught a single subject over the course of one 13-week university semester in Autumn 2015. The next section describes ethical considerations, the participants of the research, data-collection instruments and data-analysis strategies.

3.6.1 Ethical considerations

An ethics application outlining the main considerations of this research was submitted to the University of Wollongong's Ethics Committee. The committee approved this research in 2014 and approval was extended annually throughout the duration of the study.

Following ethics approval, participants were recruited as follows:
An email was sent to university teachers in the Faculties of Education, Humanities and the Arts, and Engineering and Information Sciences, inviting them to participate in the study. This email included a copy of the participant information sheet (Appendix A) which outlined:

- The aims of the study;
- The participants' role in the study;
- Details of supervisors;
- Information about voluntary participation and ability to withdraw from the study;
- Storage of data;
- Details of ethics committee and how to make a complaint;
- Reporting of findings.

The university teachers who volunteered to participate in the study were evaluated against *selection criteria* in consultation with the researcher's supervisors (Table 3.4). This evaluation was undertaken to see whether participants came from a variety of contexts, had the workload of a full-time academic and used an active Moodle site in their teaching. Thus, the evaluation ensured that participants were suitable for the research and a range of academic disciplines were represented.

Table 3.4 – Criteria for selection: Collective case studies

Selection criteria	Justification
University teachers from different academic disciplines	University teachers were selected from different academic disciplines to allow for variations in content and pedagogy (Shulman 2005).
Full-time university teachers, with the 'standard' work profile of an annual research workload, teaching workload and governance	University teachers were selected to represent the range of activities typical to a full-time academic position in higher education.
Active use of a learning management system in their institution	Online observations of teaching were undertaken, and subject artefacts and documents were collected and analysed. For example, this included subject outlines and assessment rubrics. Online observations provided examples of how university teachers used technology in their online teaching.

Following this, participants were invited to participate in the study. An email was sent to each individual participant and a one-on-one meeting was organised to explain the nature of the study. During this meeting, potential participants were informed about their role in the study, that participation in the research was voluntary and that all information collected about them would remain confidential. At the conclusion of this meeting, participants were invited to sign a consent form. Consent was sought from all participants prior to participation.

Data-management procedures were used throughout this research to maintain participant confidentiality. Names and identifying participant details were securely stored on a password-protected computer to ensure the identity of the participant was not revealed. Pseudonyms were used throughout this thesis. Interview transcripts were also member-checked by all participants except Anthony, and errors were corrected.

3.7 Cases

The purpose of this research was to provide detailed accounts of multiple university teachers' technology integration. Seven university teachers from one Australian university were involved in this study. Table 3.5 shows how each of the participants met the selection criteria.

Table 3.5 – Criteria for selection: Participants

	Gina	*Tatyana*	*Ji*	*Richard*	*Arabella*	*Anthony*	*Stephanie*
Criterion 1: Chosen from one of the following academic discipline areas: Social Sciences; Law; Humanities and the Arts; Engineering and Information Sciences; and Science, Medicine and Health	X	X	X	X	X	X	X
Criteria 2: Full-time university teacher, with the 'standard' work profile of an annual research workload, teaching workload and governance		X	X	X	X	X	X
Criteria 3: Active use of a learning management system in their institution	X	X	X	X	X	X	X

Table 3.6 outlines the characteristics of each of the seven university teachers involved in the study. Included in this table are details regarding each participant's pseudonym, gender, discipline and career status.

Table 3.6 – Participant details

Participant name	**Gender**	**Discipline**	**Career status**
Gina	Female	Education – Early Years	Early-career
Tatyana	Female	Education – Educational Psychology	Late-career
Ji	Male	Information Technology	Late-career
Richard	Male	Psychology	Late-career
Arabella	Female	School of Education – English as a Second Language	Mid-career
Anthony	Male	Arts - Principles of Graphic Design	Mid-career
Stephanie	Female	Education – Educational Technology	Mid-career

3.7.1 Site

All participants in the study were employed at the University of Wollongong (UOW) on the south coast of New South Wales, located approximately 80 kilometers from Sydney. This university is known as a research-intensive university, with exceptional teaching practices across a range of discipline areas, leading to its recognition as one of the top 2% of universities in the world. UOW has a number of campuses both in Australia and internationally, including Sydney, Batemans Bay, Shoalhaven, Bega, Dubai and Hong Kong. The university is divided into five Faculties: Social Sciences, Business, Law, Humanities and the Arts, Engineering and Information Sciences, and Science, Medicine and Health. Both undergraduate and postgraduate degrees are offered to domestic and international students, with a total of 32,000 students and 2,700 staff members and an economic impact of $2 billion in activity per year.

Each year, there are two 13-week semesters. One semester runs during Autumn, typically from March to June, and the other semester runs during Spring, typically from August to November. These semesters generally include a mid-session break and a final exam period. A shorter summer semester is held from December to February for a limited number of subjects. Delivery of content varies withinin and across subjects and programs. Subjects can be delivered on-campus, online or via a blended learning model which includes both face-to-face and online content. Regardless of delivery mode, all UOW subjects must have an active Moodle site with a copy of the subject outline and a place for assessment submission (University of Wollongong, 2014). Subject outlines provide students with key subject information, including subject description, subject learning outcomes, subject delivery, subject attendance and subject assessment. Subjects generally include lecture material, activities exploring foundational concepts (e.g. these activities can be held during face-to-face tutorials, workshops, student labs or via online modules – depending on delivery mode) and subject readings. For on-campus subjects, university teachers have access to lecture-capture technology to record face-to-face lectures or videoconferencing tools to deliver live lectures to students across multiple UOW campuses. Online lectures can be pre-recorded through the use of the institution's ECHO platform. In addition to lecture capture technology and videoconferencing, institutional technologies offered to UOW staff include, Moodle and associated activities and Microsoft products.

The University of Wollongong has a student-centred approach to teaching and learning, and academic staff are encouraged to help students thrive, grow and achieve. As part of the University's strategic plan, staff are expected to deliver 'intellectually challenging programs to the highest standard in technology-rich and immersive environments' (University of Wollongong, 2020, p.10). Goal 2 of the strategic plan highlights that UOW will:

- Modernise [their] academic course to ensure it is attractive, efficient and that every student has real-world, inquiry-led, technology-enriched, intellectually challenging and globally connected learning opportunities.

- Make sure that learning within or outside of the formal curricula, in the classroom or digitally, is invigorated through engaged staff, supportive learning communities and innovative learning environments' (University of Wollongong, 2020, p.10).

There are a range of UOW support resources to assist academic staff with teaching and learning practices. For example, at an institutional level, the unit Learning, Teaching and Curriculum (LTC) is dedicated to excellence in teaching and learning and offers support to UOW's five faculties. Some of the services they offer are:

- Programs to develop and review teaching practice, such as professional development workshops, online self-paced modules, peer review of teaching and grant programs;
- Educational resource development, such as developing interactive learning content (e.g. animations, simulations and virtual reality), web-content, and video and audio production;
- Learning Analytics, specifically to provide university teachers with real-time data that they can use to understand and optimise student learning environments, and;
- Online learning teams who provide university teachers with support on the effective use of technology in teaching.

Faculty-based resources also exist to support university teachers with their educational practices, such as:

- Technology-Enhanced Learning unit(s), which focus on providing high-quality support for digital learning practices.

University teachers employed at UOW generally follow a workload model of 20% administration, 40% research and 40% teaching. For example, the roles and responsibilities of a lecturer at UOW may include (University of Wollongong, 2020, p. 5):

- The conduct of tutorials, practical classes, demonstrations, workshops, student field excursions, clinical sessions and studio sessions.
- Initiation and development of subject material.
- Acting as subject coordinators;
- The preparation and delivery of lectures and seminars;
- Supervision of the program of study of Honours students or of postgraduate students engaged in course work;
- Supervision of major Honours or postgraduate research projects;
- The conduct of research;
- Involvement in professional activity;
- Development of course material with appropriate advice from and support of more senior staff;

- Marking and assessment;
- Consultation with students;
- A range of administrative functions the majority of which are connected with the subjects in which the academic teaches;
- Attendance at departmental and/or faculty meetings and/or membership of a number of committees.

3.8 Data collection

Over the course of one Australian university semester, data were collected from seven participants. Data collection occurred during Autumn Semester 2015, which ran over the course of 13 weeks from March to June. Each participant was involved in two one-hour interviews: one at the beginning of the semester and one at the end. Six observations of teaching were undertaken; these provided the stimulus for the end-of-semester interview. Out of the six observations, three were face-to-face observations and three were online. During online observations, the researcher also collected subject artefacts and documentation, including subject outlines and assessment rubrics. All subjects observed in this study had an online Moodle site.

3.8.1 Data-collection procedures

Each participant's teaching in one subject was observed over the course of one 13-week university semester in Autumn 2015. The following table provides a description of the subjects observed identifying whether they situated in an undergraduate or postgraduate degree.

Table 3.7 – Subject details

Participant name	Subject	Subject description	Postgraduate/ undergraduate subject
Gina	Education – Early Years	Subject 100 is a first-year blended-learning subject designed to engage students in the historical, social and legal aspects influencing early childhood care and education.	Undergraduate subject involving a blended-learning approach. Students meet face-to-face every second week for a three-hour workshop; alternative weeks involve an online workbook for students to complete.
Tatyana	Education – Educational Psychology	Subject 800 explores learning theories and their application in educational contexts. Students explore both traditional and contemporary learning theories and apply them to their relevant context.	Postgraduate subject with on-campus and distance students. On-campus students meet weekly for a three-hour workshop: one-hour lecture and two-hour tutorial. Distance students complete the subject online.
Ji	Information Technology	Subject 700 focuses on system-development methodologies. Students explore both frameworks and issues that allow them to assess different system methodologies and compare the tools and techniques of system methodologies and the stages of system developments.	Postgraduate subject involving a weekly three-hour workshop: two-hour lecture and one-hour tutorial.
Richard	Psychology	Subject 400 is a fourth-year subject that focuses on assessment in clinical psychology. Students are involved in developing an understanding of case conceptualisation through addressing a specific child case.	Undergraduate honours subject involving a one-hour lecture and two-hour weekly workshop.
Arabella	Education – English as a Second Language	Subject 900 is an introductory subject to the selection, development and evaluation of materials and computer technology for second-language teaching. Students are involved in exploring how to successfully support second-language learners through computers and online materials.	Postgraduate subject involving a weekly three-hour workshop: one-hour lecture and two-hour tutorial.
Anthony	Arts – Graphic Design	Subject 200 is a second-year subject exploring visual design principles and knowledge regarding graphic user interface design and brand development.	Undergraduate subject involving a one-hour weekly lecture and three-hour weekly studio.

Stephanie	Education – Educational Technology	Subject 101 is a first-year education subject targeting technology integration in teaching. Students explore learning theories, contemporary ICTs and educational-technology research.	Undergraduate subject involving a one-hour weekly lecture and two-hour weekly tutorials.

Table 3.7 highlights that out of the seven participants, four taught education-based subjects (two undergraduate and two postgraduate), one taught an information-technologies-based subject (postgraduate), one taught a psychology-based subject (undergraduate) and one taught an arts-based subject (undergraduate). The four university teachers teaching education-based subjects had varying expertise. One participant's expertise was in educational psychology, another in early years and the remaining two in educational technology.

3.9 Data-collection instruments

3.9.1 Interviews

Interviews provide the researcher with information about participants' experiences and perspectives on an issue or problem (Creswell, 2009; Patton, 2002). Interviews were an important part of this research, as they allowed participants to share their unobservable thinking about the use of technology in their teaching. Through the collection and analysis of interview data, the researcher could identify issues and interpretations that would address the proposed research question, as well as identify gaps to be explored through further research. Although interview data produces valuable information, the perspectives that individuals provide are subjective due to the nature of self-reporting; thus, multiple forms of data were collected throughout this study to address this concern.

For this study, two one-hour semi-structured interviews were conducted. These interviews were held in person with each participant at the University of Wollongong. Semi-structured interviews were chosen because they provided the researcher with flexibility during the interview process (Lewis-Beck, Bryman & Liao, 2004). Instead of being bound by a set of questions, the researcher could ask the participant additional questions based upon their responses. For the purpose of this research, two interviews were scheduled, one at the beginning of the semester and one at the end, to explore participants' thinking, design and teaching over the course of one 13-week university semester. The beginning-of-semester interview focused on gathering information about each participant's' teaching history, their role at the university, their approach to teaching, their teaching commitments and the subject chosen to be part of this study. The same beginning-of-semester interview schedule was used for all participants partaking in this research (Appendix B). An end-of-semester interview asked each participant questions based on what the researcher observed during face-to-face teaching and online observations (Appendix C). A specific interview schedule was developed for each participant to address observational data and allow

the participant's thinking to emerge about particular instances. All interviews were audio recorded and transcribed. At the end of the semester, transcriptions were sent to participants for review to allow changes to be made. All participants except Anthony reviewed their transcriptions.

When developing interview schedules, the researcher was guided by the conceptual framework of this study, which draws on three theoretical constructs: Mishra and Koehler's (2006) TPCK Framework, Bandura's (1977) Theory of Self-Efficacy and Eccles et al.'s (1983) Expectancy-Value Theory. A pilot interview was conducted with one university teacher at the University of Wollongong to check the clarity of interview questions. The pilot interview took one hour and focused on asking the university teacher the proposed beginning-of-semester interview questions for this research. At the end of the pilot interview, the participant was asked for feedback to see whether they had understood each question and whether the questions were effective. The university teacher's feedback indicated that the questions were clear and easily understood. No adjustments were made to the beginning-of-semester interview questions.

3.9.2 Observations

Observations were used to collect data about each participant's technology use in two settings: face-to-face teaching (e.g. lecture, tutorials/workshops/seminars/studios) and online learning (via the learning management system Moodle, which was used across the institution). Through undertaking observations, the researcher was looking for evidence of technology use within the real life setting of the teacher's face-to-face and online classes. The researcher aimed to see if and how technology was being used and what pedagogical approaches accompanied technology use across various teaching contexts: face-to-face lectures, tutorials and workshops, and online activities via Moodle. Further, the researcher also aimed to observe the roles of the teacher and their students during technology use. During Autumn 2015, the researcher audited one subject of each university teacher over the course of one 13-week university semester (Table 3.7). The researcher negotiated with the participant about which face-to-face classes they would observe. Field notes gathered during face-to-face observations focused on the participant's teaching and how they used technology in their teaching. Emerging ideas and interpretations were noted during these observations. During online observations, the researcher observed each participant's Moodle site. The researcher observed the university teacher's teaching and collected subject artefacts and documentation, including their subject outline, support materials they had uploaded (such as assessment rubrics) and evidence of teaching and learning activities (e.g. discussion posts made by the university teacher) (Table 3.8). The observations and accompanying field notes were used to develop end-of-semester interview questions for each participant. Asking participants questions based on observed teaching practices allowed richer cases of the investigated phenomenon, as participants could provide their ideas, thinking and perspectives about specific instances.

Table 3.8 – Data collection: Artefacts

Artefact	Purpose of collection
Moodle	Moodle was used to provide evidence of how participants integrated technology into their teaching.
Subject outline	Subject outlines were gathered to provide specific information around the subject and to explore whether technology was integrated into student assessment items.
Discussion posts	Discussion posts were used to provide evidence of participant's technology use in an online environment.
Assignment submission and marking rubrics	These were used to verify participants' technology use.

No student artefacts were collected.

3.10 Data-collection procedure

Data collection focused on capturing participants' technology use whilst teaching in a specific academic context. Each participant's teaching of a single subject (either undergraduate or postgraduate) was observed and data were collected over one 13-week university semester in 2015. Data collection occurred before, during and after the teaching of this semester. This method of data collection aimed to capture the participants' actions and thinking before, during and after the subject's implementation. The time of each face-to-face observation and interview was negotiated with each participant to suit their schedules and to ensure that technology use could be observed if included in their teaching.

Table 3.9 – Data collection overview

Data-collection phase	Data collected for each participant	Focus	Timing
Pre-implementation	• One-hour beginning-of-semester interview	• Background • Teaching history • Role at the university • Approach to teaching • Teaching commitments during Autumn 2015	Two to four weeks before the Autumn 2015 session
Implementation	• Three face-to-face observations of the participant's teaching • Three online observations of the participant's subject Moodle site • Subject artefacts and documents collected during online observations	• Observations of each participation's teaching in one subject • Included both online and face-to-face teaching • Collected evidence of teacher's technology use in a specific subject	Beginning, middle and end of a 13-week university semester
Post-implementation	• One-hour end-of-semester interview	• Reflections on implementation of subject and technology use	After the session had concluded and teaching was complete

Phase 1: Pre-implementation – background and selection of subject

This phase focused on collecting background information about each participant. A beginning-of-semester interview was held with each participant prior to the university semester. This interview ran for approximately one hour and was audio recorded and transcribed. The interview protocol, which was used for all participants, guided the researcher to ask questions about each participant's' teaching history, their role at the university, their approach to teaching and their teaching commitments. Once this interview was conducted, each participant, in negotiation with the researcher, selected one of their subjects to be observed as part of this research. When selecting this subject, the researcher was mindful that:

- Technology was being used in the teaching of the subject; and
- There was a balance of undergraduate and postgraduate subjects selected for this research to allow any differences to emerge, for example between student cohorts.

Phase 2: Implementation of the subject

This phase of the study focused on observing how the participants used technologies in their face-to-face and online teaching environments. Three face-to-face observations and three online observations were undertaken during this second phase of the study, which ran for the duration of one 13-week semester. During online observations, artefacts and subject documentation were collected from each participant's online Moodle site. Face-to-face data-collection times were scheduled in consultation with each participant.

Table 3.10 – Data collected from each participant

Phase	Data collected	Gina	Tatyana	Ji	Richard	Arabella	Anthony	Stephanie
Pre-implementation	One interview	X	X	X	X	X	X	X
Implementation	Six observations	X	X	X	X	X	X	X
Post-implementation	One interview	X	X	X	X	X	X	X

Phase 3: Post-implementation

Data collection during this phase occurred once the subject was complete. In this phase, the researcher aimed to capture each participant's reflections on their teaching through an end-of-semester interview. This interview protocol varied for each participant, and individualised interview schedules were developed. The observational data collected on each participant during Phase 2 provided stimulus for each end-of-semester interview. Generally, each schedule focused on specific instances observed during face-to-face and online teaching and invited participants to reflect on their overall subject's design, technology use and teaching. Each interview ran for approximately one hour, and was audio recorded and transcribed. The interview was scheduled in consultation with each participant.

3.11 Data analysis

Data analysis was undertaken in this study to identify themes and patterns in the data and to draw conclusions to answer the research question (Creswell, 2009). As reinforced by Creswell (2013) 'case study research involves a detailed description of the setting or individuals, followed by analysis of the data for themes or issues' (p. 246). Data were coded according to emerging themes and patterns, and then

interpreted according to the theoretical framework of this research via a priory code, which drew on three theoretical constructs: Mishra and Koehler's (2006) TPCK Framework, Bandura's (1977) Theory of Self-Efficacy and Eccles et al.'s (1983) Expectancy-Value Theory. This process required the researcher to show subjective judgement 'all while realising their own conciousness' (Stake, 1995, p.41). Open coding was further used for this investigation because it allowed the researcher to examine the data for meaning, whilst looking for reoccurring patterns and identifying information that was important to the study. The main data-analysis activities for this research are presented below (data management, reading and memoing, describing, classifying and interpreting and representing and visualising). These activities are based on Creswell's (2007) data-analysis techniques for case-study research.

3.11.1 Data management

Creswell (2007) described data management as the first stage of data analysis. This process involves the organisation, transcription and member-checking of data. For each case, all interviews were transcribed, and hard-copy field notes were typed into an electronic format. Each participant in the study was sent an electronic copy of their interview transcripts through email for member-checking. Member checking is a process 'that can be conducted at the end of an interview' (Erlandson et al, 1993, p.142) 'whereby data are tested with members from whom the data was originally collected' (Lincoln & Guba, 1985, p.314) to ensure credibility and check accuracy. All participants except Anthony were involved in member checking. Following this process, data were organised into electronic folders. These folders were named according to the phases of data collection: pre-implementation, implementation and post-implementation. Within each folder, data were labelled according to what was being collected, and documents were given descriptive labels. For example, Observations> Stephanie> Online Observations> Observation 1.

3.11.2 Reading and memoing

Following data management, the researcher spent time becoming familiar with the data. Interview transcripts and field notes were read in their entirety, and subject artefacts and documents were reviewed. Whilst reviewing the data, the researcher documented preliminary ideas and initial connections to literature in her reflective journal. The researcher paid particular attention to the data that had relevance to the research question, specifically data that related to the participants' technology use in their subject, including how and why technology would be used and how knowledge, self-efficacy and technology value influenced technology use. Even though some of the data did not specifically relate to the research question, emerging themes were also noted. These notes were then used to develop a coding framework (Appendix D), which was collated in a separate electronic document. This document outlined and defined the main codes and sub-codes.

3.11.3 Describing

This stage involved describing the facts of each case. This occurred in two distinct ways: a document summarising key information about each case and a detailed case description. The summary document included information about each participant's background, their position at the university, their discipline area, their teaching responsibilities in 2015, the subject observed as part of this research and the technologies used in their teaching. The researcher then used this document to formulate a detailed case description for each participant. These descriptions, which were refined throughout the course of the study, are presented in Chapter 4 of this thesis.

In Chapter 4, the following terminology (Table 3.11) is used during the reporting of each case:

Table 3.11 – Definitions of key concepts/terms used in Chapter 4

Term/Concept	Definition
Successful technology use	University teachers show a clear intent for using technology in teaching, they draw on instructional/pedagogical strategies to integrate technology in their teaching and their integration meets their objective for using the technology and/or enables students to successfully achieve the intended learning.
High TPCK	Characteristics of high TPCK include: • Openness to experimentation • Strives to be consistently on task for the content being taught. • Approaches instructions with clear and systematic pedagogical strategies in mind • Makes connections for their students as to 'why' a particular technology is useful for instructing a particular topic. • Recognises that all strategies do not work for all students • Not only general technology skills but also knowledge about the types and specific uses of technology that are most likely to facilitate teaching and learning in each subject
Low TPCK:	Characteristics of low TPCK include: • Teachers deliver content at a surface level only • Can choose the appropriate technology to teach a particular subject but they have not been able to fully explore specifically how the software can be integrated into the teaching and learning process
High Self-efficacy:	Characterictics of high self-efficacy include: • Set challenging goals, commit to challenges and strive to meet their goals • Manage potential threats and lower their stress and anxiety • Experience repeated success at a task and feel less threated by minor setbacks • See others succeed and feel that they can succeed too • Practice completing a task with success and gain experience • Facilitates cognitive processes and performance
Low self-efficacy:	Characterictics of low self-efficacy include: • Doubt their capabilities and experience anxiety • Pessimistic about their developments and accomplishments • Experience failure, hindering their decisions and beliefs in themselves to succeed • Avoid innovation and complex tasks, instead relying on basic and simple activities
High Value:	Characterictics of high value include: • Makes tasks relevant

	• Selecting tasks focused on learning objectives
Low value	Characterictics of low value include: • Avoids considering the relevance of the task • Avoids selecting tasks focused on learning objectives

3.11.4 Classifying and interpreting

Next, the researcher developed coding categories from the issues that emerged from the data, as well as from the theoretical framework of this investigation. The qualitative analysis software NVivo was used to code the data and identify patterns. The preliminary discussion and cross-case analysis presented in Chapters 4 and 5 of this thesis reveal patterns that emerged from the examination of the data. The final chapter of this thesis presents naturalistic generalisations resulting from the researcher's interpretations of the data (Lincoln & Guba, 1985).

3.11.5 Representing and visualising

The final stage of data analysis focused on presenting the outcomes of this research. Chapters 4, 5 and 6 provide this analysis in chronological order. Chapter 4 provides a preliminary analysis of each case. Chapter 5 presents a cross-case analysis to identify similarities and differences between cases and profile each participant using the three theoretical constructs. Chapter 6 presents interpretations of the data. These chapters include detail about the data and analysis along with quotes from the university teachers. Punctuation and grammar errors were corrected when presenting these quotes.

3.12 Quality of the study

To preserve the validity and reliability of research, Creswell (2007) mentioned that two out of the following eight validation strategies should be employed by researchers: prolonged observation in the field, triangulation by reviewing multiple sources of data, peer debriefing, negative-case analysis, minimisation of researcher bias, member-checks, thick description and external audits. This study used a number of measures to promote verification; these are summarised in Table 3.12.

Table 3.12 – Validation strategies

Strategy	How employed in study
Prolonged observation in the field	• Data collection took place over the period of one 13-week university semester. • The researcher engaged in six observations throughout the course of the semester: three face-to-face observations of teaching and three online observations of the participant's Moodle site. • Field notes recorded the events that occurred during these observations. • This method allowed the researcher to develop rapport with the participants, follow their thinking over an extended period of time and develop a more holistic picture of what was happening in a naturalistic context.
Triangulation	• Multiple data sources were collected: interviews and observations of teaching. During online observations, artefacts and documentation were collected from each participant's Moodle site. • These data sources provided evidence to address the research question. • Triangulation of multiple sources was used to crosscheck the findings of the study and to reveal any contradictions within the data.
Peer debriefing	• This process was undertaken with the researcher's supervisors, who provided feedback on the study's methodology, analysis and findings.
Researcher bias	• The researcher identified how her subjectivities influenced the inquiry by documenting these in Chapter 3 of this thesis.
Member-checking	• Interview transcripts were sent to participants for review and feedback. • All participants except Anthony reviewed their interview transcripts.
Thick description	• Chapter 4 outlines seven detailed and rich case studies. • Each case includes background information, quotes and context to allow the reader to make a judgement on the transferability of the findings.

3.13 Role of the researcher

Qualitative research involves the researcher being immersed in the study. This in turn requires the researcher to reflect on her experiences and discuss how her subjectivities influenced this inquiry. As outlined by Mackieson, Shlonsky and Connolly (2019) 'Qualitative research methods have traditionally been criticised for lacking rigor, and impressionistics and biased results' (p.965), thus the researcher sought to understand the term 'bias' and disclose her subjectives. Through a review of the literature the term bias is defined as:

'In research, bias occurs when "systematic error [is] introduced into sampling or testing by selecting or encouraging one outcome or answer over others. Bias can occur at any phase of research, including study design or data collection, as well as in the process of data analysis and publication' (Pannucci & Wilkins, 2010, p.1)

'Interpretive research begins and ends with the biography and self of the researcher). This notion of how one's self influences one's research interests is generally the beginning of our discussion on the issue of bias in research' (Denzin, 1989, p. 12).

The researcher has a teaching background and has worked in primary schools and in a higher-education setting. She has an interest in educational technology and educational psychology, specifically the psychological factors influencing technology use in teaching. The researcher has published research and lectured in educational technology and educational psychology. She currently works as an educational technologist in a higher-education institution, supporting university teachers and their use of technology in teaching. Throughout the duration of this study, the researcher was the main instrument for data collection. To minimise her subjectivities, the researcher took a non-participant role in the study and identified how her subjectivities influenced data collection and analysis. Further, the researcher discussed reflections with her supervisors.

3.14 Chapter summary

The research adopted a qualitative approach, which allowed an in-depth investigation of seven university teachers who each taught a single subject in Autumn 2015. A multiple case study approach was used to explore each participant's technology use in their teaching. Data were collected over the course of one 13-week university semester and occurred in three phases: pre-implementation, implementation and post-implementation. Multiple data sources were obtained throughout the duration of the research, including interviews (a beginning-of-semester interview and an end-of-semester interview) and observations (three face-to-face observations and three online observations). Subject artefacts and documentation were collected during online observations. These data sources were analysed using the following processes: data management, reading and memoing, describing, classifying and interpreting

and representing and visualising. During data analysis the research question and theoretical framework were considered, and emerging themes and patterns were noted. Verification procedures were employed to enhance the quality of the research and allow an assessment of the researcher's interpretations.

Chapter 4
Results

4.1 Introduction

This chapter presents a narrative account of each of the seven cases in this investigation. Each case is structured as follows:

- About the participant: This section provides a profile of each participant, including their previous employment history, role at the university and teaching responsibilities in Autumn 2015.
- About the subject: This section describes the subject that was observed as part of this research, including subject information, delivery and assessment.
- About technology use: This section outlines how the participant integrated technologies into their teaching of a single subject and why.
- Reflections on teaching: This section addresses the participant's reflections on their technology use after the subject had concluded.
- Summary and preliminary analysis: This section provides an overview of the case and highlights key points. This section also presents an initial analysis of specific technology examples and how they provide evidence of TPCK, self-efficacy and technology value.

Table 4.1 presents an overview of each case (in order of presentation) and includes the participant's pseudonym, discipline area and career status.

Table 4.1 – Overview of participants

Participant name	Discipline	Career status
Gina	Education – Early Years	Early-career
Tatyana	Education – Educational Psychology	Late-career
Ji	Information Technology	Late-career
Richard	Psychology	Late-career
Arabella	School of Education – English as a Second Language	Mid-career
Anthony	Arts – Principles of Graphic Design	Mid-career
Stephanie	Education – Educational Technology	Mid-career

4.2 Case 1: Gina – first-year undergraduate education (early years) subject

I'm feeling quite confident with it now but there's still heaps to learn.

4.2.1 About Gina

Gina was a part-time lecturer in the School of Education. She was employed in the Early Years program on a two-year contract and liaised with regional campuses offering the Early Years degree to complete administrative tasks related to student timetabling and marketing. Unlike other participants in the study, Gina was not employed in a full-time academic position, as she was completing doctoral studies. Given Gina's 22-year-long role as an early-years educator and her involvement in a new blended-learning approach in the Early Years degree, she was selected as a participant in this study. Prior to Gina's employment as a part-time lecturer, she had worked sessionally at the university for four years tutoring in education-based subjects, including creative arts, educational psychology, early-years mathematics, early-years child development and early-years health, wellbeing and safety.

Gina's teaching responsibilities included coordinating two undergraduate subjects in the Early Years program: a first-year early-childhood context subject and a second-year health, wellbeing and safety subject. The first-year subject was designed to introduce students to the relationship among historical, legal and social factors affecting early-years education and care. It was built upon a number of early childhood education frameworks, and included exploration of legislation, policy, support services and resources. The second-year subject focused on a comprehensive approach to safety, nutrition and health. It addressed preventive approaches to health, early-intervention strategies and the relationship among family and community. In 2015, both of these subjects were designed according to a blended-learning approach, in which course content was delivered both online and face-to-face.

4.2.2 About the subject – relationship among historical, legal and social factors on early-years education and care

Gina was the subject coordinator of Subject 100, which was a 100-level subject offered in the School of Education. This subject was designed to provide students with an understanding of the relationship between historical, legal and social factors affecting early-childhood education and care. The subject explored national regulations, standards and assessment with a focus on the Early Years Learning Framework, and introduced students to legislation, resources and support services for families and educators. The subject was designed to raise student awareness of historical perspectives and inform their understanding of context and practice. The subject assisted students in developing relationships with their placement centre and the wider community, with the expectation that they would develop an understanding of the connections between theory and practice.

Gina first taught Subject 100 in 2015. Although this subject existed prior to Gina's role as subject coordinator, it had not been designed according to a blended-learning approach. In 2015, the Early Years degree was redesigned to include online and face-to-face teaching for on-campus students and students studying at three regional campuses. This degree was restructured to strengthen relationships with Early Start Engagement Centres in regional areas and to provide increased flexibility and access to higher education:

> *[The degree] acknowledges that students' lives have changed. For a lot of students, it's no longer an option to be a full-time student but there's [a] need to balance home/life/work/family and university.* (Gina, Beginning-of-Semester Interview, 2015)

The overall design of each subject in the Early Years degree was guided by Carmen, the director of the Early Years program. Carmen's overarching approach focused on consistency in design and delivery for both face-to-face and online teaching. Face-to-face workshops were held every fortnight and each subject's Moodle site followed a consistent format. As Gina reported:

> *I took the lead from [Carmen]. Essentially each week I put things into a workbook. We integrated lecture content in between activities and connected readings. Then there'd be an online forum that [students] might respond to [based on the] lecture or reading so that students are being guided in their critical thinking about the content.* (Gina, Beginning-of-Semester Interview, 2015)

Subject 100 had a total of 48 student enrolments. This subject was designed to run for one 13-week university semester and included both online and face-to face teaching. During online weeks, students completed three hours of activities on their subject Moodle site. Gina described how content and activities were organised into workbooks and flowed in a logical manner. At the beginning of each workbook, Gina listed learning outcomes that students would achieve through completing the workbook. Examples of activities embedded within workbooks included lecture recordings, YouTube videos, readings, links to websites and discussion forums:

> *In [an] online week, you have [a] combination of lecture time where they're listening to a lecture, then there'd be supplementary readings...or resources or websites that [students] might go to. Sometimes I [would] link [students] to a YouTube clip…there would [also] be…forums in a fully online week. The forums were around learning...being applied, there's reflective thinking going on or some applications for practice that they would discuss.* (Gina, End-of-Semester Interview, 2015)

During online weeks, student participation was monitored through a completion progress bar on the subject's Moodle site that recorded student participation in online activities.

Every fortnight two-hour face-to-face classes were held for on-campus students. Gina said that there was an expectation that students would complete online material prior to attending face-to-face workshops, showing the use of a flipped-classroom pedagogical approach. Because students were to complete online activities prior to class, face-to-face workshops focused on extending and consolidating student understanding of online content through problem-solving and discussion, showing a constructivist approach to learning:

> *That's the culture we've got to build, is that you come to your workshop class with those things completed so that then, ideally, it makes that face-to-face time productive and helps them to see that there's a reason for engaging with the material, that it's going to follow through.* (Gina, Beginning-of-Semester Interview, 2015)

Subject 100 included four assessment tasks: a social bibliography (20%, due in Week 4), a research report (30%, due in Week 9), an online participation activity (10%, randomly selected throughout Weeks 1-13) and professional-experience requirements (40%, due Weeks 12 and 13).

The social bibliography involved students writing a 2,000-word reflection on their personal and professional identity. Throughout their report, students needed to refer to the Early Years Learning Framework, relevant theory and historical perspectives to identify the relationship between theory, experience and practice. Following this, the 2,500-word research report involved students selecting a topic from a given list and using online sources and academic literature to write a report addressing the relevance of their topic to contemporary early childhood. Students needed to also create a two-page handout to accompany their report. This handout summarised key information on their topic and included references separate from those included in their report. The next assessment, the online participation activity, focused on student participation in 'online lectures, set readings and shared learning community discussions' on their subject Moodle site. Students needed to show engagement in at least 80% of online learning. Lastly, the Mentor Centre requirements focused on student professional experience. This assessment involved:

- Maintaining an 80% attendance record at their mentor centre;
- Completing a situational analysis, which was a series of questions related to learning in the subject and engagement at their mentor centre;
- Completing six detailed reflections related to the practical application of information addressed in the subject; and

- Engaging in an online discussion about their professional experience in Week 13.

Technology use was integral to Assessments 3 and 4. For Assessment 3, students needed to show participation in at least 80% of online activities on Moodle throughout the course of the semester. These activities related to participation and engagement in online workbooks; for example, participation in discussion forums. Assessment 4 also incorporated technology use. This assessment included participation in a reflective discussion forum on Moodle where students reflected on their professional experience and engaged in reflective dialogue with staff and peers.

4.2.3 About technology use

Gina explained that one of the main reasons she used technology in her subject was that it was mandatory for Moodle to be used in all subjects across campus, and addressed how technology use was expected in the Early Years degree since the introduction of blended learning in 2015:

> *There's definitely an expectation; it's a requirement now for our Early Years degree. It definitely is an expectation; there's not a choice – this is the way we're delivering.* (Gina, Beginning-of-Semester Interview, 2015)

To meet university requirements, Gina spoke about attending a workshop to evaluate her subject's Moodle site:

> *I had gone to a workshop [as] a way of evaluating our Moodle site to make sure it's sort of ticking all of those boxes and certainly providing things like the subject outline, which is central.* (Gina, End-of-Semester Interview, 2015)

Although Gina noted that the use of Moodle was mandatory, she valued this tool in her teaching, because it provided one central space for students to access all necessary material for the subject:

> *Moodle [is] really that one-stop shop for the subject. If you're providing all of [the] underpinning resources and information, then no student can say they were ignorant [of] the writing conventions or the layout of the subject or the goals of the subject.* (Gina, End-of-Semester Interview, 2015)

Lecture and workshop observations showed several ways in which technology was integrated into Subject 100. Examples included the use of Moodle (e.g. online activities, including the use of discussion forums) and PowerPoint. These tools were used in Gina's teaching to give students access to online learning materials and to support student engagement with the content.

Example 1: The use of Moodle

Online observation showed that Gina used Moodle in her teaching. Moodle was used to deliver online content to students on a fortnightly basis. This content was organised into workbooks that typically included mini-lectures in the form of videos, YouTube clips, readings and discussion forums. Gina explained how the content in workbooks was designed to be relevant to face-to-face teaching and assessment tasks in the subject:

> *We've broken our lectures into mini-units of content that would fit within a weekly topic. What we've tried to do in the workbooks is [guide] the students through a topic of content so that they might watch a 15-minute lecture and then they might do a reading; they might then discuss it in a forum and so on. I've then really tried to make any activities or forum discussions that they do be really relevant to an assessment task or to something that we were going to do in a face-to-face workshop so that they see the relevancy of the content.* (Gina, End-of-Semester Interview, 2015)

Gina said that Moodle was introduced as a central component to Subject 100 to meet the requirements of a blended-learning approach and as a way of delivering content to students that accommodated their outside lives and allowed flexibility in completing tasks:

> *So, essentially, the reason we've structured it and used Moodle that way is [that] it provides students with the flexibility to do the course work when it suits them, around their work and family commitments, and I think there's huge power for students. You know, for example, previously lectures were optional, so, you know, students half the time wouldn't bother turning up to lectures, and so you'd have a large part of the student cohort not necessarily connecting with the content adequately, whereas this Moodle has enabled all of the content to be made very relevant to practice.* (Gina, End-of-Semester Interview, 2015)

Online observation showed that discussion forums were embedded into Gina's Moodle site. Some forums were designed to support student understanding of content, whilst others were used for reflective purposes. One such forum, in Week 13, invited students to reflect on their learning throughout the semester and their experiences whilst on placement. Gina explained that online discussion forums allowed her to assess each student's contribution and gave all students, including international students, who could be hesitant to speak during face-to-face discussions, an active voice in the learning process:

> *I didn't want to just grade their face-to-face discussion; the face-to-face discussion was really supplementary because there's no way in a face-to-face context that I could get around and actually assess each student's quality of comment. The online forum enabled me to do that and get them to reflect on their time in [professional placement] if they'd been already allocated and attending a service; or, if they hadn't yet been allocated, I broadened the focus so that they could also reflect on their first semester at [university] and what they'd learned. And the face-to-face activities that I did that week were just an extension of that…even some of our international students who are hesitant to talk, they did fantastic.* (Gina, End-of-Semester Interview, 2015).

In addition to content-based discussion forums encouraging understanding and reflection, online observation showed that assessment related discussions forums and a general subject discussion forum were available on the subject Moodle site. Assessment-related discussion forums were designed for students to asks questions about specific assessment tasks. The general discussion forum, however, was used for troubleshooting purposes and general questions about assessment:

> *The general discussion forum is really about troubleshooting, so most of the questions are assignment related: 'How would I reference such-and-such' or 'Is the question asking for this or that?' It's really just a place they can send their queries. So it means theoretically, you're much more consistent in the advice you're giving than when it would be a face-to-face workshop.* (Gina, End-of-Semester Interview, 2015)

To support students in the completion of online activities, Gina uploaded support material to Moodle. For example, students were instructed to create a visual poster based on their own professional identify. To scaffold student learning, Gina created and uploaded a sample of the task to Moodle. She explained that this was a way for students to have a clear understanding of the task's expectations and to differentiate between the requirements of an online activity and an assessment task:

> *I deliberately did the sample because I figured without that, the task was a bit ambiguous. I really wanted them [students] to see, I designed [the] sample literally in five minutes; so, I didn't make it too polished because I didn't want them to treat it like an assignment, and that's the challenge. You've got your online content and you've got your assignments. You could really overload students by making the online activities too complex rather than just being a reiteration of content that then leads into some of the things that are required in assignments.* (Gina, End-of-Semester Interview, 2015)

Other support resources available on Moodle included academic-writing resources. These resources were developed collaboratively with Mary from Learning Development and Carmen, the Early Years director. Gina had articulated that her previous experiences of teaching higher-education students in her

discipline had shown that first-year students demonstrated limited understanding of academic-writing practices; she included these materials on her site to support students when completing their assignments:

> *A lot of students come to [university] without those [writing] skills. We have to train them in expectations. I worked collaboratively with Mary at Learning Development support and we'd had a meeting between Mary, Carmen and [me] prior to session to sort of say, 'At what points do we integrate some learning development content?' So we made that choice, and I made the choice to put it in Week 8, which was the week before their big report was due. So, I treated that learning-development content as a way that they could prepare and polish their work. The smart students accessed it then and were really working on their research in a nice, integrated way, and I actually released access to the Week 8 content in about Week 5 or 6 so that the more diligent students would access it earlier than it was actually delivered. Because it was a fully online week, I encouraged them to access it as early as they possibly could.* (Gina End-of-Semester Interview, 2015).

Online observation also showed that assessment marking rubrics where uploaded to Moodle. Gina highlighted that these rubrics were provided to students as a checking tool:

> *I think the rubric is really important as a strategy to make sure that they use that as sort of [a] checking tool to make sure they've achieved all the criteria, because obviously the rubric aligns with the criteria for the subject.* (Gina, End-of-Semester Interview, 2015).

Another way Moodle was used in the subject was for assessment submission. Students submitted Assessment 1 and Assessment 2 online through Turnitin module(s) available on their subject's Moodle site:

> *There's a common deadline and…sometimes marking online is a little bit of a pain but then, for me, it means I'm not lugging 70 bits of paper around either. It means then that [students] are responsible for their submission, there can't be any excuses really.* (Gina, End-of-Semester Interview, 2015).

Example 2: The use of PowerPoint

Face-to-face observation showed that PowerPoint was used in Subject 100. Gina said that she had used PowerPoint to support the delivery of subject content, and that her slides were carefully designed to only include key points:

> *To create…a touchstone for your conversation and to add visual[s]. What I've learned from working in professional development is that you just don't put all the content on the PowerPoint – that the PowerPoint slides should really just be those keywords that help a participant sort of track their listening and track their participation…they fill [the slide] by taking notes and doing the readings and all that. It really just gives a touchstone for the content really.* (Gina, End-of-Semester Interview, 2015)

4.2.4 Reflections on teaching

After the subject was complete, Gina said that she was pleased with how the subject went. She indicated that there were some issues with Moodle; however, the students were proactive in contacting her to have these issues resolved:

> *I'm really pleased with how it's gone. I mean there's been a few little glitches to iron out with the setting up of Moodle, but the students have actually become quite good at letting us know if they can't access something and it'll just be because you've not done the settings right in terms of release dates or something. But, overall, really good.* (Gina, End-of-Semester Interview, 2015)

Although Gina highlighted the benefits of online learning, she mentioned some issues that had arisen when students were using the online workbooks on Moodle, specifically in relation to Echo360:

> *There were some students having trouble…. What we were doing was hyperlinking the* Echo360 *recordings within the content. So rather than them having to access the recording via the Echo block, we were trying to make it that once they were in a workbook for that week's content that the hyperlink would be within that workbook. What happened was that it was more of a structural…when we did the hyperlink direct to the Echo block, for some students in whatever internet environment they were in, it was tending to just time out on them.* (Gina, End-of-Semester Interview, 2015)

To overcome this issue, Gina worked collaboratively with Camellia, who provided technical support:

> *With the support of the IT lady that we work[ed] in partnership with, we realised that if we as lecturers actually went to managing our Echo site and [we took] the hyperlink from there, then we eliminated the glitch.* (Gina, End-of-Semester Interview, 2015)

Gina felt that overall discussion forums were another way to evaluate success in her subject, and explained that discussion forums allowed students to engage in reflective practices:

> *The forums were really around creating an equivalent platform to [come] together face-to-face so that the learning is being thought about, it's being applied, there's reflective thinking going on or some applications for practice that they would discuss.... It gives every single student both the voice and to hear their own thinking and to apply their own thinking in meaningful ways.* (Gina, End-of-Semester Interview, 2015)

Gina found the general discussion forum to be effective for troubleshooting. She felt that it allowed students to contact her about an issue that they were experiencing when using Moodle to complete online activities:

> *The good thing about the discussion forum on Moodle was that, you know, you're having that conversation with the student who's having the issue but what that does is flag it for anyone else who's having the issue as well. While I say it was a glitch, they were all minor sorts of things. Where I wasn't sure what the problem was, then we've got the IT support but, more often than not, it's just faster for me to…I've become quite good at trouble shooting so you just sort of go in and work [it] out…. The settings in Moodle are quite intuitive so if you just basically go through the editing settings then you can pretty much fix it.* (Gina, End-of-Semester Interview, 2015)

On the other hand, Gina did not find all types of discussion forums effective; specifically, the assessment-specific discussion forums:

> *I won't use them again next year. They were not an effective…. I thought that they could have topic-specific dialogue with each other as much as with me if they had any questions, but I found that they tended to continue to just use the general discussion forum or the dialogue box. So, I won't do topic-specific ones next year.* (Gina, End-of-Semester Interview, 2015)

Gina's reflection on her use of Turnitin showed that she wanted to learn more about uploading rubrics to Turnitin and transferring student marks from Moodle to the university's Student Management Package (SMP):

> *I haven't played enough with the grade-mark function of Moodle, where you can actually set it all up so that you're putting the grade in Moodle and then importing it across to SMP. I kind of know how to do it but I didn't bother doing it because it was a bit tricky, because I broke down some of the assignments into bits, and so then combining that in a way that would import into SMP was a bit messy. I need to think about that for next year.* (Gina, End-of-Semester Interview, 2015)

In her reflection on the subject, Gina also spoke about how her level of confidence in using Moodle had changed over the course of the semester. She felt that repetition and practice had allowed her to build her

knowledge of how to complete Moodle-based tasks, and elaborated by stating that without regularly completing tasks it is easy to forget and requires relearning. At the conclusion of the subject, Gina said that she was more confident using technology. However, she felt that there was still more she could learn, and identified time as a factor that affected learning about technology:

> *More and more confident. I mean I did nothing but design two subjects over Christmas, but it's satisfying to do it well and I think we're doing it really well in Early Years, like probably more than any other faculty in education: there's strong consistency, and I think as we build that, I think our students benefit immensely from having the content all there. I'm feeling quite confident with it now but there's still heaps to learn, and the frustrating thing is you never have the time to fiddle, and it does take fiddling. Sometimes you sort of resent the amount of time it takes to learn the skills that make it easier.* (Gina, End-of-Semester Interview, 2015)

Gina's reflection also addressed her use of technology in a face-to-face environment. The main tool Gina used in workshops was PowerPoint. In her reflection, Gina said that she was confident using this tool in her teaching:

> *I'm quite comfortable with PowerPoint. I did develop the skills of PowerPoint; we used PowerPoint as the tool for our daily documentation because PowerPoint is easier for manipulating photos and moving text and so on, so we found it was the best tool available to us in that context. In my professional-development work for community childcare, I was designing PowerPoints all the time for professional-development workshops, and that's then morphed into what I do here at [university]. I like to make my PowerPoints very visual and aesthetically balanced. I think it's pleasant for a student to see if the content is well designed and nicely balanced.* (Gina, End-of-Semester Interview, 2015)

4.2.5 Themes that emerged

Overall three themes surfaced about Gina's use of technology in teaching. First, teamwork and technical support were key factors influencing Gina's design and delivery of Subject 100. Second, Gina's self-efficacy grew over the course of the semester through continual engagement with Moodle and the repetitive process of creating online activities, such as workbooks, discussion forums and Turnitin modules. Third, the use of discussion forums provided all students with an active voice in learning, encouraged reflection on content and professional experience, and provided support around the use of Moodle and assignment completion.

Teamwork and technical support were key factors influencing Gina's design and delivery of Subject 100. In 2015, a blended-learning approach was implemented across the Early Years degree. Carmen, the

director of the Early Years program, guided Gina and her colleagues in the design and delivery of their subjects, providing evidence of teamwork amongst colleagues aiming to achieve a consistent approach to technology integration in a single degree/program. Consistency was seen in the timing of face-to-face classes and also in how Moodle sites were designed. When Gina was developing her subject Moodle site, support was available from Carmen and her colleagues, as well as technical support from Camellia, who had been employed to assist the Early Years team with the development of online content on Moodle. Camellia assisted Gina with some online activities and also provided support when Gina encountered a technical problem on Moodle. It is evident that leadership from Carmen, a collaborative Early Years approach and technical support from Camellia influenced the integration of technology in Subject 100.

Gina's self-efficacy developed over the course of the semester, growing from experimenting with technology and completing the same online tasks on a regular basis. Tasks that Gina completed regularly were creating online workbooks with mini-lectures, YouTube clips, readings and discussion forums. Gina's developing self-efficacy highlighted how her beliefs in her abilities did not remain constant; instead, they changed over time due to experimentation and repetition.

Gina believed that online discussion forums gave all students an active voice in learning, which was sometimes difficult to achieve in a face-to-face setting. Gina's interview also highlighted that reflective discussion forums allowed students to show their understanding of content and make connections to professional experience. In reflecting on the overall success of the subject, Gina said that reflective discussion forums were successful in her teaching. Although Gina had used different types of discussion forums in her subject (e.g. subject discussion forum, assessment discussion forums and reflective discussion forums), she had a clear understanding of how she would use discussion forums for different purposes, such as troubleshooting, assignment support and teaching.

4.2.6 Discussion

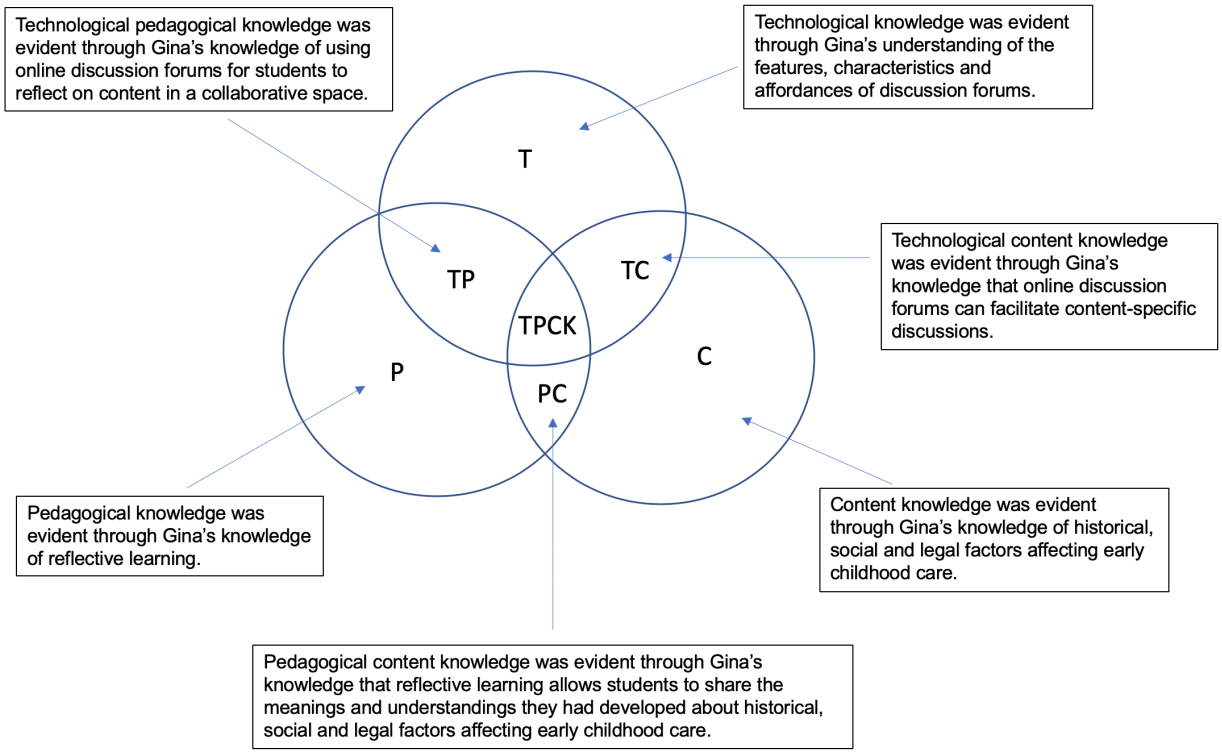
The following section gives two examples of Gina's successful use of technology in Subject 100. These examples are presented and analysed in terms of knowledge, self-efficacy and technology value.

4.2.6.1 Discussion forums

Gina's technological, pedagogical, content knowledge was seen in her use of reflective discussion forums. These forums, available on her subject Moodle site, allowed students to share their understandings of content and make connections to professional experience. An analysis of the example of reflective discussion forums suggests that Gina could successfully combine her knowledge of technology, pedagogy and content to use these forums in her teaching. First, Gina showed knowledge of content, related to historical, social and legal factors affecting early childhood care. Second, Gina showed

evidence of pedagogy through the use of reflective learning. Workbooks were designed to include engagement with content and then reflection. For example, students listened to a traditional lecture and read literature to receive foundational knowledge on a topic before creating a forum post showing their understandings or perspectives. These steps showed that Gina organised information into a logical structure and scaffolded students' learning so that they could access knowledge on a topic prior to communicating their ideas. These practices relate to principles of Cognitive Load Theory (Sweller, 1988; Sweller 1994), where information should follow a clear structure and build on prior knowledge, and the notion of scaffolding, where support is provided to students to achieve learning objectives. Gina's knowledge of technology was also seen in the publishing tool of discussion forums on her subject's Moodle site. She showed an understanding of the features and characteristics of this technological tool. Specifically, she showed knowledge of how to create a discussion forum on Moodle, create a post providing instructions for the task and navigate through the forum to access student contributions.

Below is a graphic representation of the knowledge domains found in Gina's use of online discussion forums in her teaching:



4.2.6.1.1 How self-efficacious was Gina in using technology?

An analysis of the above example has shown that Gina's self-efficacy for using reflective discussion forums developed over the course of the semester. There were two sources of self-efficacy influencing the belief Gina had about her ability to integrate discussion forums in her teaching: mastery experiences and vicarious experiences.

Mastery experiences contributed to Gina's developing self-efficacy as she frequently developed subject discussion forums on a fortnightly basis and experienced success with these forums. These successes reassured Gina that her students would effectively engage with discussion forums to complete learning task(s) and that the forums would run smoothly without any technical issues. Through analysing the influence of mastery experiences on Gina's self-efficacy, it can be seen that Gina's past successes with forums raised her self-efficacy and allowed her to feel more competent in their use. Evaluating student learning also impacted Gina's self-efficacy and allowed her to feel more competent using forums in Subject 100, simply because she could see that students were achieving the goals of the task as intended.

Vicarious experiences was another source influencing Gina's self-efficacy for discussion forums. Gina sought technical support from Camellia and received guidance, modelling and demonstrations on how to use discussion forums and further, troubleshoot any issues or problems that arose with this technology in her teaching. Through Camellia modelling tasks and providing guidance, Gina was able to see that the task was possible to complete, and she too could achieve the task or troubleshoot a technical problem or issue. Thus, vicarious learning was another factor influencing Gina's self-efficacy for discussion forums as she observed the actions of her colleague, Camellia, whom she believed had a high level of technical knowledge. This in turn enhanced Gina's self-efficacy beliefs.

4.2.6.1.2 What value did Gina place on technology?

An analysis of the above example showed that Gina valued the use of discussion forums in her teaching. She believed that discussion forums allowed students to show a deep understanding of content and further enabled all students to contribute their ideas about a specific topic and make connections to practice. She felt that the forums gave all students an active voice, especially those international students who were hesitant to participate in face-to-face discussions. Thus, the value Gina placed on discussion forums in her teaching links to Eccles's construct of utility value. This concept was evident in the example because Gina saw the usefulness of the technology and how it could positively impact student learning.

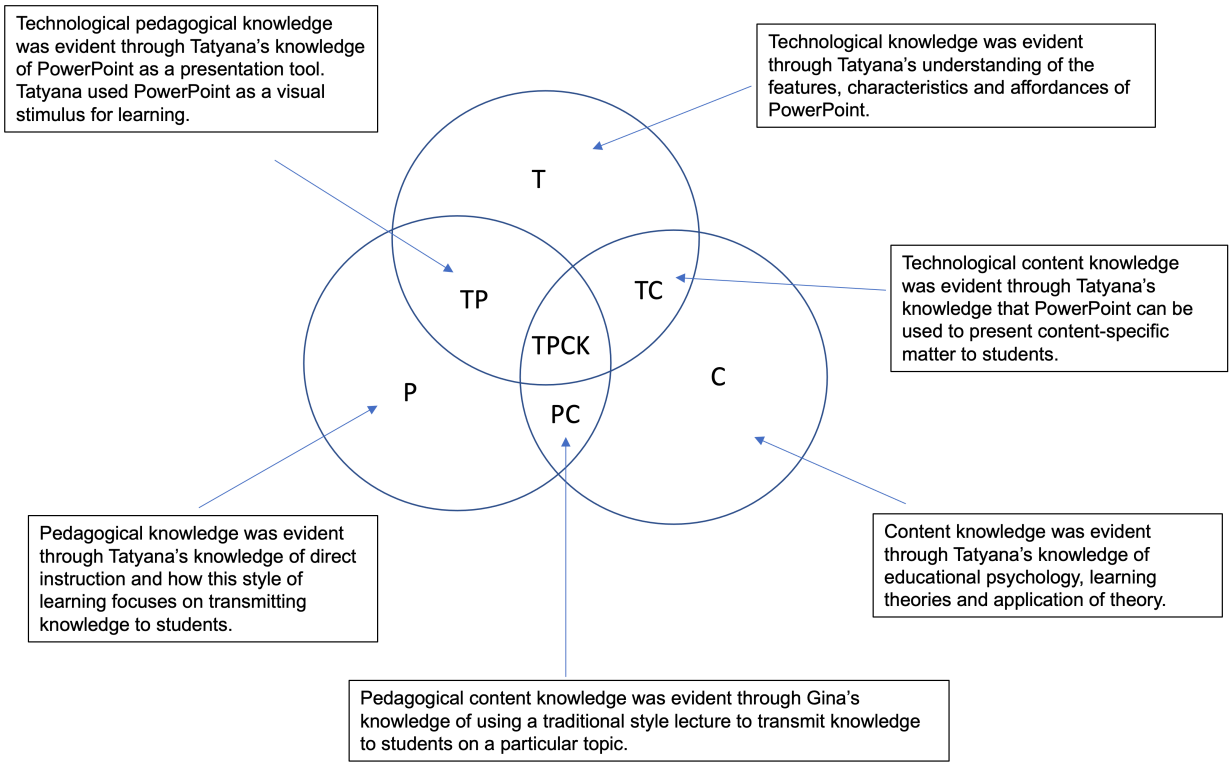
Overall, the above example has illustrated that Gina was able to draw on her knowledge of technology, pedagogy and content to effectively use discussion forums in her teaching. Her self-efficacy was dynamic and changed over the course of the semester as she regularly created discussion forums as part of fortnightly workbooks. Gina valued the use of discussion forums as part of a blended-learning approach

because she believed that they showed evidence of student learning outcomes and gave all students an active voice in learning. A relationship among the theoretical constructs is also evident. For example, initally, Gina had limited knowledge on how to create discussion forums on Moodle, however, through developing an understanding of this process through her work with Camellia (vicarious experiences) Gina's knowledge developed and her self-efficacy for the activity grew.

4.2.6.2 The use of PowerPoint

Another example of Gina's technological, pedagogical content knowledge was seen in her use of PowerPoint. During face-to-face classes, Gina used PowerPoint to support her discussion of subject content. Each slide of the PowerPoint included key points and images. From analysing this example, it was evident that Gina was able to bring together her knowledge of technology, pedagogy and content to use PowerPoint as a visual support for learning. For example, she showed knowledge of content, as she had a solid understanding of key concepts related to early-years education. She further showed evidence of pedagogy through the use of direct instruction. Gina was able to transmit knowledge to students through the traditional lecture style, where students were passive recipients of knowledge. Finally, Gina showed knowledge of technology, specifically the presentation tool PowerPoint and its associated uses and affordances. Through knowledge in these three areas and their combination, Gina showed evidence of TPCK in her teaching.

Below is a graphic representation of the knowledge domains found in Gina's use of PowerPoint in her teaching:



4.2.6.2.1 How self-efficacious was Gina in using technology?

An analysis of Gina's use of PowerPoint showed that she had a high level of self-efficacy for this tool directing relating to Bandura's concept of mastery experience. Gina's high self-efficacy was a result of her previous experiences using PowerPoint, both in her career as an early-years educator and in the work, she completed at the university. She explained that she felt confident and comfortable in her abilities to use PowerPoint because of her extensive experience. Thus, this example provides evidence of mastery experience as Gina's repeated success with PowerPoint over an extensive period of time strengthened her self-efficacy beliefs and allowed her to feel competent in the use of the PowerPoint to deliver content matter to students.

4.2.6.2.2 What value did Gina place on technology?

An analysis of the above example showed that Gina valued the use of PowerPoint in her teaching. Gina believed that PowerPoint was important in a face-to-face environment when delivering subject content. She felt that PowerPoint served as a visual support for discussions and allowed students to have a summary of overall key points and concepts. She also felt that students had the opportunity to extend her summary by taking notes during her presentation. Thus, the value Gina placed on Powerpoint in her teaching links to Eccles's construct of utility value. This concept was evident in the example because Gina saw the usefulness of the technology in providing a visual stimulus for student learning.

Overall, this example has shown how Gina was able to draw on her knowledge of technology, pedagogy and content to effectively use PowerPoint in her teaching. This example further illustrates how Gina's extensive experience in using PowerPoint was a key factor in allowing her to feel highly self-efficacious in its use. Thus, this provides evidence of the relationship that exists between TPCK and self-efficacy. Through Gina's extensive experience with PowerPoint this strengthened her knowledge of the tool and its use in teaching and boosted her self-efficacy for the task. An analysis of the case study also showed that Gina valued PowerPoint in her teaching of Subject 100 because it provided a visual support for student learning.

4.2.6.3 Conclusion

The above two examples provide evidence of how Gina effectively embedded discussion forums and PowerPoint into her teaching. Discussion forums were used to assess student understanding and allow students to make connections to professional experience. PowerPoint was used to support Gina's delivery of subject content and provide a visual stimulus for learning. Gina showed that within the context of each individual activity that her self-efficacy varied: it continually developed and grew over the course of the semester for discussion forums, and it began and remained high for the use of PowerPoint. Gina valued these tools in her teaching because they gave all students an active voice in learning (discussion forums) and provided students with a visual support for learning (PowerPoint). An analysis of Gina's case shows that her success was also supported by her colleagues and technical support.

4.3 Case 2: Tatyana – postgraduate educational psychology subject

Time was the issue... I'd rather do it myself, but I think that my skills are far from… automatised.

4.3.1 About Tatyana

Tatyana was a Senior Lecturer in the School of Education; her area of expertise was in Developmental Psychology. Tatyana had worked in the School for 16 years in full-time lecturing positions. She lectured in educational and developmental psychology across all major education programs, including the Bachelor of Education – Early Years, Bachelor of Primary Education and Master of Education. Her research focused on the application of sociocultural psychology and Activity Theory to the study of effective technology use across different educational contexts, such as literacy, mathematics and special education. Tatyana was the International Student Director for students in Education, Psychology, Geography and Health and Society. As part of this role, Tatyana was involved in accepting international student applications, coordinating international events and organising on-campus social events for international students.

Tatyana's teaching responsibilities included both undergraduate and postgraduate education subjects. She coordinated three subjects, one early-years undergraduate subject and two postgraduate subjects in the Master's program. The first-year undergraduate subject, including 62 student enrolments, was part of the Bachelor of Education – Early Years. This subject, which was designed around a blended-learning approach, introduced students to the concept of play as a pedagogical approach to education and care, with a focus on infants and children from birth to five years. The second subject was a postgraduate subject offered in the Master's program. This subject, including 60 student enrolments, also addressed play as a pedagogical approach to child learning and development in early childcare. This subject presented similar content to the early-years undergraduate subject Tatyana taught. The third subject was a postgraduate subject that addressed the relevance of learning theories to education. Classical and modern theories of teaching and learning were addressed in this subject, with a focus on the relationship between theory and practice. Approximately 60 students were enrolled in the subject, with a third of the students being on campus and the remaining students completing the subject online.

4.3.2 About the subject – teaching postgraduate students the principles and applications of educational psychology

Tatyana was the subject coordinator of Subject 800, a postgraduate Master's subject offered in the School of Education. This subject explored the application of learning theories to educational practice. Students were expected to apply theoretical perspectives to their area of specialisation in education. They needed to identify key learning theories underpinning education, critically analyse these theories and describe their practicality in a specific educational context. The classical and contemporary learning theories explored in this subject were Behaviourism, Piaget's Theory of Cognitive Development, Vygotsky's Sociocultural Theory, information processing and modern theories of creativity and intelligence. Through participation in this subject, it was expected that students would develop an understanding of the relationship between theory and practice in an educational setting.

Subject 800 was first coordinated by Tatyana in 2013 and then again in 2015. The subject had run in the School of Education for nine years before Tatyana's appointment. Once Tatyana was appointed coordinator, minor revisions were made to the subject's design, such as the inclusion of online discussion forums and revised assessment tasks to have an increased relevance to practice. Tatyana outlined that these changes were made in response to the feedback students provided on a subject evaluation, and in an effort to better align the subject with her approach to teaching:

> *The essay I changed…to suit more [of] what I teach in the subject with the emphasis on importance of play…before it was a different assessment task.* (Tatyana, Beginning-of-Semester Interview, 2015)

Subject 800 had a total of 26 student enrolments. This subject was designed to run for one 13-week semester. Two cohorts of students were enrolled in the subject: face-to-face students and distance/online students. Face-to-face students were taught in workshops by Tatyana and distance/online students were taught by Carol, a colleague working in the subject. The subject was organised into six online modules, where each module ran for two weeks and was based on a set chapter of the subject text, which had been written by Tatyana and her colleagues at the university. All online modules were available on the subject Moodle site, and activities were designed by Tatyana and/or Carol and then created online by Carol. At the end of each two-week module, a face-to-face class was held for on-campus students. These classes had two key focuses. The first half of the workshop involved Tatyana presenting key ideas to students about a specific learning theory. The second half involved students delivering a presentation based on the previous week's content to meet the requirements of Assessment 2.

The subject included three assessment tasks for face-to-face students. These assessment tasks were: a journal article review (30%, due in Week 7), a PowerPoint presentation (30%, due as scheduled) and an essay (40%, due in Week 13). These assessment tasks were the same for online/distance students; however, instead of delivering the PowerPoint in a face-to-face setting these students submitted their PowerPoint and notes to Moodle.

The journal-article review was an individual task that involved students locating and annotating a research article relevant to an aspect of theory addressed in the subject and their future professional practice. The assessment required students to complete a one-page summary of the article, including the article's reference, a background statement, information about the participants, methods and results and a conclusion addressing the article's implications for practice. The next assessment was a PowerPoint presentation in which students analysed an allocated topic and its implications. Face-to-face students submitted their PowerPoint via Moodle, as well as completing a presentation during class time. Online students submitted their PowerPoint and presentation notes online via Moodle for marking, and no class presentation was held. Face-to-face students were given the option of working individually or in pairs, and their presentation needed to be 20-25 minutes in length. Each face-to-face presentation needed to include a PowerPoint, activities and discussion. The final assessment, an essay, focused on students answering one of the questions posed to them. Students had a choice of seven questions related to concepts presented in the subject.

All three assessments were submitted online to Turnitin; however, the PowerPoint presentation was also delivered during class time for face-to-face students. Technology was required to complete each of the assessment tasks, as students needed to use either Microsoft Word or PowerPoint to create their assignments. Submission to Turnitin also required the use of technology, as students had to access the online Turnitin module on Moodle to upload their assignment.

4.3.3 About technology use

Tatyana explained that the main reason she used technology in her teaching was that her university had made it mandatory for each subject to have a Moodle site. During Tatyana's interview, she expressed that technology was important to use in her teaching, as it fostered interaction among students. She believed that the use of discussion forums in her teaching gave students the opportunity to discuss content, especially when content was challenging:

> *I believe that students need interaction for their learning. I think they should have a chance to talk about the theories, it is not an easy subject – so yes, I like them to discuss because it really helps them to learn.* (Tatyana, End-of-Semester Interview, 2015)

Lecture and workshop observations showed that technology was integrated into Subject 800. Examples included the use of Moodle and PowerPoint. These forms of technology were integrated into the subject to support student learning, provide access to subject resources and allow discussion about subject content.

Example 1: The use of Moodle

Online observations showed that Tatyana used Moodle in Subject 800 to provide students with access to lecture notes, discussion forums and Turnitin, specifically for assignment submission:

> *I uploaded lectures, I did those discussions, I did submission of the tasks.* (Tatyana, End-of-Semester Interview, 2015)

Online observation showed that Tatyana uploaded support resources such as marking rubrics for assessment tasks to Moodle. She felt that these provided students with an additional guide to complete their assessment:

> *Those rubrics should be used as [an] additional guide for the assessment so [students] know what [to] work towards and what they're going to be ticked against, so they don't miss components. So that's what I like to do. I don't know whether they all do that or not, but I believe they should, and that is why I provide the rubrics well ahead of time.* (Tatyana, End-of-Semester Interview, 2015)

Observation showed that online discussion forums were used in Subject 800. These discussion forums were compulsory for online students to complete as part of their attendance in the subject. Face-to-face students could also participate in these forums, but they were optional, as they attended face-to-face classes. These forums were introduced to students to allow reflection on topics addressed in the subject. Observation showed that students needed to respond to a key question on a topic as well as comment on another student's post:

> *We picked some questions for each topic and we had nine topics in the subject, so for each topic we picked an essential question related to outcomes for each of the modules…something which we want them to highlight and we wanted them to discuss it. So we provided a question for discussion, and then I also provided them guides that they have to respond to the question and then to each other.* (Tatyana, End-of-Semester Interview, 2015)

To scaffold students in the completion of an online discussion post, Tatyana highlighted how she provided students with a simple guide on creating discussion posts. She outlined how this guide related to her research on discussion forums:

> *We gave them a simple guide. I work[ed] on it [for the purpose of] research which is still in progress, but it is for [a] different subject. In this subject they used it in a simple way. I asked them to post to the forum, one in response to the question and one in response to a student. Secondly, I also guided them a little bit that the post should be short without any quotes, in spoken-like manner rather than, you know, a long-written text, cut and paste, with quotes. I didn't want that; I wanted that interactive and reasonably spontaneous….* (Tatyana, End-of-Semester Interview, 2015)

Observation showed that Turnitin was used in the subject for the purpose of assessment submission. All students submitted Assessments 1 and 3 online. Tatyana explained that her colleague Carol was responsible for online marking via Turnitin, whereas Tatyana marked face-to-face presentations:

> *I got Carol to look after it, so I spared myself from marking those in this subject. She marked assessment tasks 1 and 3 and I marked [the] oral presentations.* (Tatyana, End-of-Semester Interview, 2015)

Example 2: The use of PowerPoint

Observation showed that Tatyana used PowerPoint during face-to-face workshops to present key ideas to students. Her PowerPoints included both text and images:

> *I aim to have major points for each chunk of information I'm discussing…. What else do I do? Images, obviously, so it's not "death by PowerPoint". Images to make them, you know, pleasant to look at, and also what I do is images…. I don't know whether it is of any interest to you, but I like to choose images which support the content, so they can relate, not just nice to look at but they support what I'm trying to say, create the mood, create the background, to what I am talking about.* (Tatyana, End-of-Semester Interview, 2015)

Tatyana explained that the main reason that she included PowerPoint in her teaching was that it is part of university culture and common practice among university teachers:

> *I use PowerPoint if I present a lecture and I [use] it face-to-face for one class…. It's essential because otherwise it's kind of now unheard-of doing without a PowerPoint.* (Tatyana, Beginning-of-Semester Interview, 2015)

4.3.4 Reflections on teaching

Tatyana's reflection showed that the subject did not go as well as she hoped. She felt that student dynamics had an influence on the overall success of the subject, as she needed to cater for both face-to-face and distance students:

> *It was all right. I wouldn't say it was brilliant, but it was all right. Another lecturer and I divided the students between ourselves but it's been a bit awkward delivering for both groups in the same subject. For next year I will have to book a room with recording capacity, so I can record the lectures in the class because it wasn't possible this year.... I have to just rethink how I teach this subject.* (Tatyana, End-of-Semester Interview, 2015)

> *Carol was teaching and looking after distance students, and we have been juggling between providing online tutorial activities for [distance] students and hav[ing] face-to-face tutorials for those who are face-to-face. My problem is that I like to have something more consistent between the two cohorts. How I'm going to do it, I don't have a clue, but I'll try to.* (Tatyana, End-of-Semester Interview, 2015)

Tatyana noted that she ran online discussion forums for distance students; however, she felt that these forums could have been more effective:

> *For distance students I suggested to Carol some ideas on how to run discussion with distance students, but I don't think it worked terribly well – but it was all right. I think it was satisfactory.* (Tatyana, End-of-Semester Interview, 2015)

Tatyana also elaborated on her disappointment with face-to-face students' engagement in discussion forums. She felt that because she had not made this task compulsory for this cohort of students, their participation was low. She reflected on how she would change this so that face-to-face students would actively engage in online discussion forums:

> *Those who attend face-to-face then ask whether they have to participate in the forum and I say, 'No, you don't have to because you attend,' and then it's kind of becoming awkward – what if they want to participate? I said, 'If you want to you can post to the forum,' but then they don't because they don't have to, and it's something which I'm not happy about.* (Tatyana, End-of-Semester Interview, 2015)

In her interview, Tatyana said that some students had had issues with assessment submission and that she had directed them to contact Carol:

> *There were some panicky moments when students couldn't upload, so I just responded to them that they had to contact Carol. So that was good for me because it was not time-consuming for me personally.* (Tatyana, End-of-Semester Interview, 2015)

Tatyana said that she wanted to learn how to mark online. She felt that this was a way to overcome the issue of students not collecting hard-copy assignments at the end of the semester and felt she could see the benefit of using an online assessment tool. However, she wanted to be able to use the tool with ease:

> *I'd rather mark hard copies, but I hate it as well because students, at the end of semester, never come to collect them so it becomes feedback kind of to nobody. So yeah, I don't know. I wish I [could] learn that Turnitin. I believe it's good. Generally speaking, I don't have any problem with that. I just want to learn that at the level of habit, so I do it easy, quickly. But it's yet not at all a habit.…* (Tatyana, End-of-Semester interview, 2015)

4.3.5 Themes that emerged

Overall three themes surfaced about Tatyana's use of technology in teaching: the use of familiar technology-based tools in her teaching, the influence of time on IT professional development and drawing on her colleague's knowledge to assist with the delivery of online content.

Tatyana's teaching of Subject 800 included the use of PowerPoint, a technology that Tatyana had used in her previous teaching. Tatyana expressed that she was self-efficacious in her use of PowerPoint and felt that she knew PowerPoint well enough to complete tasks important to her teaching. Tatyana integrated PowerPoint to communicate content matter to students during face-to-face workshops, and used PowerPoint as the key tool students needed to complete Assessment 2. Although Tatyana felt that there was always more to learn with PowerPoint, such as adding voiceovers, she was comfortable in her abilities to use this tool in her teaching. In contrast, Tatyana was hesitant to use unfamiliar tools in her teaching. She avoided these technologies, as she felt that she needed to use them with ease before integrating them into her practice.

Tatyana indicated that she wanted to learn how to use new technology-based tools in her teaching. However, she believed that time was a key factor preventing her from learning how to use new tools. She believed if she had more time to learn how to successfully integrate new technologies into her teaching, she would feel more self-efficacious in their use and consequently use them in her teaching. Tatyana spoke about the workload of higher-education teachers and how it influences the types of technology-based tasks that she feels they are able to complete. She also expressed that she would not use new

technologies innovatively in her teaching unless she first experimented with them and clearly knew how they would be used to deliver subject matter to students.

Given that Tatyana was not highly self-efficacious in using new technology-based tools and had limited time to learn them, she drew on Carol's knowledge to deliver online content to distance students enrolled in her subject. Carol was responsible for developing the subject's Moodle site. Six online modules were developed in this site, which included online activities, such as discussion forums. Tatyana's case reveals that she drew on Carol's knowledge to develop an online learning environment for her students. However, Tatyana overlooked the overall design of the subject, including face-to-face and online learning.

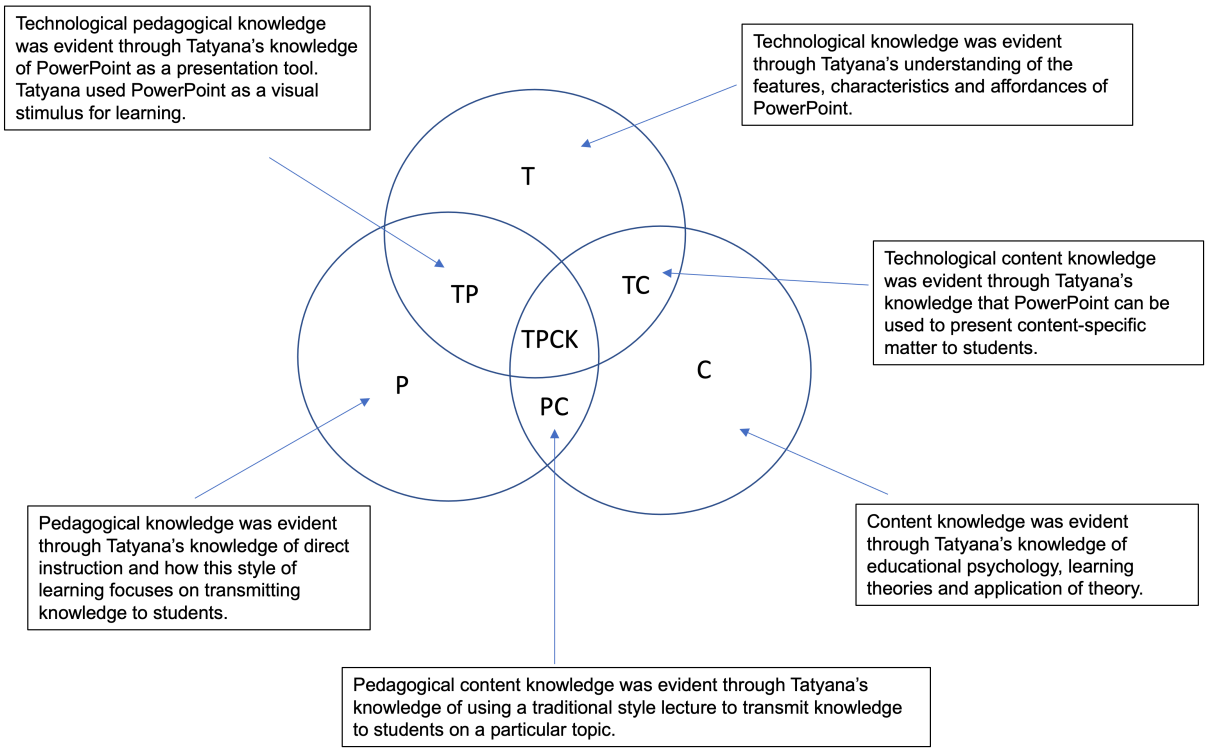
4.3.6 Discussion

The following section gives two examples of Tatyana's successful use of technology in Subject 800. These examples are presented and analysed in terms of knowledge, self-efficacy and technology value.

4.3.6.1 The use of PowerPoint

Tatyana's technological, pedagogical, content knowledge was seen in her use of PowerPoint during face-to-face classes. During face-to-face classes, Tatyana would use PowerPoint to support the delivery of content and to provide a visual support for student learning. An analysis of this example suggests that Tatyana was able to bring together her knowledge of technology, pedagogy and content to use PowerPoint effectively in her teaching. For example, Tatyana showed knowledge of content, specifically in regard to educational psychology, learning theories and application of theory. She further showed evidence of pedagogy through the use of direct instruction, as knowledge was transmitted from instructor to students about a particular topic. Tatyana also showed knowledge of technology through the selection of the presentation software PowerPoint to provide students with a visual support for learning. Key ideas, images and transitions were included in her PowerPoint slides. Through knowledge in these three areas and their combination, Tatyana was able to show evidence of TPCK in her teaching.

Below is a graphic representation of the knowledge domains found in Tatyana's use of PowerPoint in her teaching:



4.3.6.1.1 How self-efficacious was Tatyana in using technology?

The above example illustrated that Tatyana had a high level of self-efficacy in using PowerPoint because she had used this tool many times in her previous teaching. Through the continued use of PowerPoint over a sustained period of time, Tatyana showed that she could use this tool successfully for the purpose of presenting key ideas to students. Thus, previous use and exposure to PowerPoint allowed Tatyana to feel highly self-efficacious that the tool would achieve its intended purpose and work successfully. This example links to Bandura's concept of mastery experience. Mastery experience was evident in Tatyana's use of PowerPoint as her past successes raised her self-effiacy beliefs. Whilst Tatjana highlighted that she was competent in using PowerPoint to present content matter to students she did not use all the features of PowerPoint. Limited experience with other features of PowerPoint, however, did not hinder Tatyana's belief that she could use the tool for its intended purpose.

4.3.6.1.2 What value did Tatyana place on technology?

An analysis of the above example showed that Tatyana valued the use of PowerPoint in Subject 800. She felt that this tool provided students with a visual support during the delivery of content. Analysis further revealed that Tatyana's PowerPoints were carefully designed to include key points and visual images that

supported content. Tatyana did not provide an excessive amount of information on her slides and avoided images that were not relevant to the content. Therefore, Tatyana valued the use of PowerPoint in her teaching to support the delivery of information in her subject. The value that Tatyana placed on PowerPoint in teaching links to Eccles's construct of utility value. Like Gina, this concept was evident in the example because Tatyana saw the usefulness of the technology in providing a visual stimulus for learning.

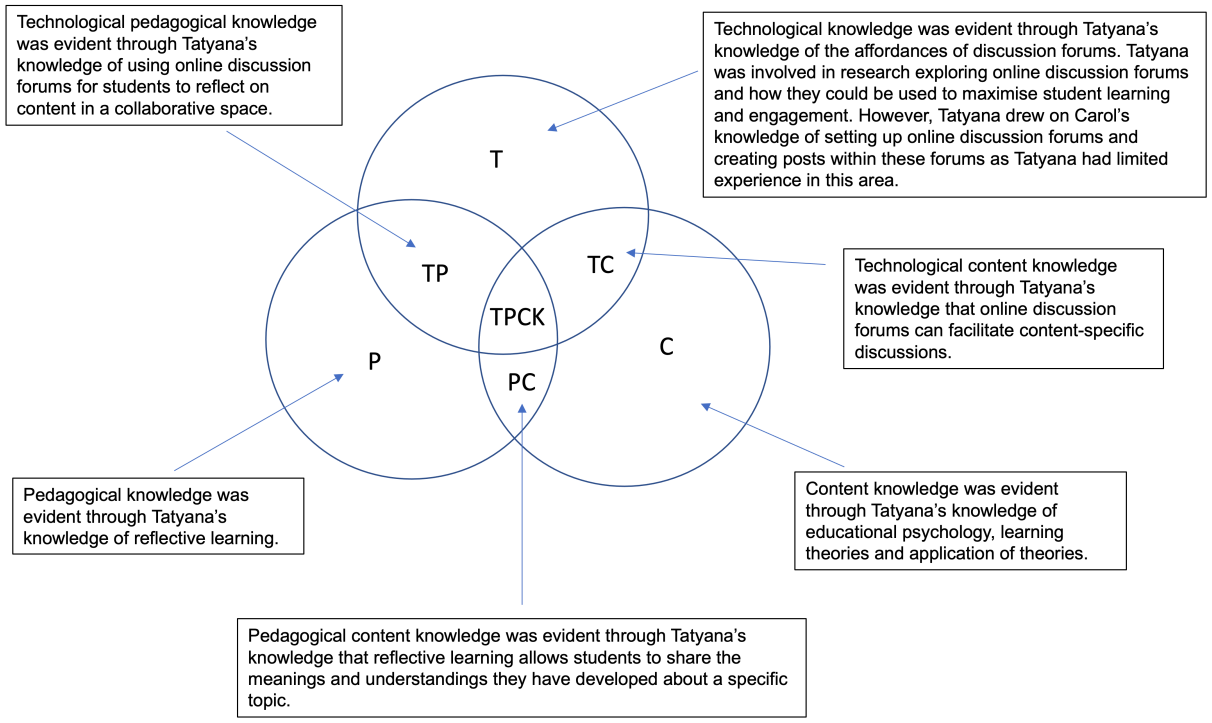
Overall, this example has shown that Tatyana was able to successfully draw on TPCK to integrate PowerPoint into her teaching. Tatyana felt highly self-efficacious in her use of PowerPoint because she had used this tool previously in her teaching. She valued the use of PowerPoint because it provided a visual support for student learning. All PowerPoints were designed to include key information and images were supportive of content. Tatyana displayed a high level of knowledge for using PowerPoint in her teaching and thus, this allowed her to feel highly self-efficacious in her ability to complete the task. Whilst Tatyana had previous experience in using PowerPoint in her teaching her knowledge of this tool was limited. She was highly self-efficacious for the types of activities she had previously completed on PowerPoint, such as adding text and images. Given her limited knowledge of other features of PowerPoint she was not highly self-efficacious in all features of the technology. Thus, this highlights that for a specific tool, the relationship between knowledge and self-efficacy can vary depending on how the tool has been used previously and whether the individual values all the features of the tool. In this case, Tatyana only valued using text and images on a slide because she believed that these features were important in the delivery of content to students.

4.3.6.2 Discussion forums

Discussion forums were available through Tatyana's subject Moodle site. These forums were designed to support student understandings of content. For example, in Week 2, a forum was specifically designed to address the topic of behaviourism, and students created posts reflecting on this topic. This forum was compulsory for distance students and optional for on-campus students. Tatyana did not create these discussion forums; instead, this task was completed by her colleague Carol, a lecturer/tutor in her subject, who displayed knowledge of how to create forums on Moodle. Tatyana did not feel she had the knowledge needed to complete this task and gave Carol the responsibility of creating online activities, including discussion forums. Although Tatyana drew on Carol's knowledge to create online discussion forums, this example still shows the successful use of technology in Subject 800. Therefore, through analysing the use of discussion forums, it was evident that Tatyana was able to draw on her knowledge of content and pedagogy and Carol's knowledge of technology to develop discussion forums that invited students to reflect on subject content. For example, Tatyana used her knowledge of content (specifically, the area of behaviourism and its associated content), her knowledge of pedagogy (through the use of reflective learning, as students had to reflect on the content to be able to provide a response to the forum) and Carol's technological knowledge (by drawing on Carol's knowledge of how to create discussion

forums on Moodle). Tatyana did, however, understand some of the affordances of online discussion as evidenced through her research on discussion forums in teaching and learning. As a result, when knowledge in all of the three areas of TPCK were combined, an integrated knowledge base was evident.

Below is a graphic representation of the knowledge domains found in Tatyana's use of online discussion forums in her teaching:



4.3.6.2.1 How self-efficacious was Tatyana in using technology?

Analysis of this example showed that Tatyana was hesitant in completing unfamiliar technology-based tasks, and expressed feeling less self-efficacious in creating online discussion forums on Moodle. Her limited knowledge and experience in this area resulted in Carol being responsible for the creation of online learning activities. Tatyana's low self-efficacy for this particular activity showed that she did not believe she could complete the task successfully, and sourced this knowledge from her colleague. The strategy of seeking support from her colleague allowed Tatyana to feel that discussion forums would succeed in her subject.

Whilst Tatyana, did not feel self-efficacious in creating online discussion forums, she understood the affordances of the technology in teaching. This was evidenced in the research Tatyana and her colleagues conducted on asynchronous online discussion forums in higher education. This research focused on how a university teacher could engage in meaningful online discussions with students

enrolled in flexible and online courses. From undertaking this research, Tatyana and her colleagues presented four interrelated components facilitating meaningful online discussions. These components include: (1) discussion forums should be engaging and reinforce and/or extend learning outcome, (2) students should be clearly taught online communication strategies, (3) a university teacher's presence in the online discussion forum should be to monitor student discussion and ensure learning outcomes are achieved and (4) students should receive clear and simple instructions on how to engage in online discussions. Thus, it is clear that Tatyana had a clear understanding of the affordances of discussion forums in teaching and learning. The above research showed that Tatyana understood how online discussion forums could be used to maximise student learning and allow meaningful, constructive engagement with content.

4.3.6.2.2 What value did Tatyana place on technology?

An analysis of the above example showed that Tatyana valued the use of online discussion forums. Tatyana explained that online discussion forums provided evidence that distance students were achieving subject outcomes. In her overall reflection of the subject, Tatyana identified that she wanted to make discussion forums compulsory for face-to-face students and wanted to address this in 2016. Thus, the value that Tatyana placed on discussion forums in teaching links to Eccles's construct of utility value. This concept was evident in the example because Gina saw the usefulness of the technology to online student learning. However, this example, also relates to another construct of Eccles's Expectancy Value Theory, cost. Tatyana saw a cost in learning how to create and manage online discussion forum given her busy workload. Whilst she valued the use of discussion forums for student learning, she was unable to prioritise the task of learning how to create and manage discussion forums due to time. This led Tatyana to employing Carol to run online discussion forums in her subject.

Overall, this example has shown that Tatyana was able to successfully use discussion forums in her subject by drawing on two knowledge sources: her knowledge and that of her colleague Carol. Although Tatyana did not display a high level of self-efficacy for creating online discussion forums independently, she believed in Carol's abilities to complete the task successfully. Tatyana valued the use of discussion forums in her teaching as they allowed an assessment of student learning. Thus, the above example shows evidence of the relationship between knowledge, self-efficacy and value. The decision to draw on the knowledge of Carol, showed that Tatyana had first made an assessment of her technical knowledge and then self-efficacy. Given Tatyana had limited technical knowledge for the task, this showed low self-efficacy and a belief she could not successfully complete the task. Thus, her assessment of the cost involved led her to employ Tatyana to run discussion forums on her Moodle site.

4.3.6.3 Conclusion

The above two examples provide evidence of how Tatyana effectively embedded PowerPoint and discussion forums into her subject. Analysis showed that Tatyana embedded PowerPoint into her subject to support the delivery of subject content and to transmit foundational knowledge to students. Discussion forums were used to provide evidence of student learning outcomes and allowed interactions among students. Tatyana's high level of self-efficacy for PowerPoint was a result of previous exposure and experience in using this tool for teaching purposes. She was hesitant to use unfamiliar tools in her teaching, and thus displayed a low level of self-efficacy for the use of discussion forums. Although Tatyana did not have the knowledge needed to create discussion forums, she knew that she could source this knowledge from her colleague, showing how collective TPCK can be used in teaching. Tatyana also believed that her colleague could create a discussion forum on Moodle; this allowed her to feel that this tool would work successfully in her subject. Tatyana valued PowerPoint and discussion forums in her teaching, as PowerPoint provided a visual stimulus for learning and discussion forums provided evidence of student learning, especially for distance students, who completed the subject online.

4.4 Case 3: Ji – postgraduate information technologies subject

> *The nature [is] a bit different. It's talking about the methodologies, [it's] not very practical. In that way, you don't have something like technology.*

4.4.1 About Ji

Ji was employed in the School of Information Systems and Technology. He worked in the School for nine years and was Head of Postgraduate Studies, a role that involved reviewing the progress of PhD students and their research. Ji was also the chair of the research committee in his school (2014 and 2015) and a committee member for an external international curriculum review body, which reviewed information-systems degrees in major countries around the world. Ji's research focused on eBusiness, service computing and cloud computing.

Ji's teaching responsibilities included the coordination of two postgraduate subjects. The first focused on eBusiness technology and addressed technology support and website creation for businesses. It addressed the fundamentals of eBusiness, including interactions between businesses and consumers, and explored standards, policies and social and economic issues related to business intranets, extranets and the internet. The second postgraduate subject addressed information-systems development. There was a focus on methodologies for system development, specifically historical and philosophical perspectives. The subject provided students with an introduction to frameworks and issues that allowed the comparison of different system-development methodologies. It focused on providing students with an understanding of the tools and techniques involved in the selection of system-development methodologies, as well as the stages of development.

4.4.2 About the subject – teaching postgraduate students the principles and applications of systems methodology

Ji was the subject coordinator of Subject 700, which was a postgraduate subject offered in the School of Information Systems and Technology. The subject was designed to provide students with an introduction to system-development methodologies, specifically from historical and philosophical perspectives. Students explored frameworks and issues surrounding the assessment and comparison of various methodologies. The subject addressed their tools and techniques and the stages of the system-development life cycle.

Subject 700 had a pre-existing design prior to Ji's role as subject coordinator. However, he made changes to the design of the subject because he wanted to align the subject to his method of teaching:

> *I think for these two subjects...they are already there for many years.... I changed a lot because later I'm the main teacher but before that another teacher.... I understand that we have about four to five teachers [who] taught this before, so every year they change according to their own needs or their own thinking about what they want to teach in that subject.* (Ji, Beginning-of-Semester Interview, 2015)

Ji also highlighted that the changes he made to the subject allowed him to feel more comfortable with its design. He believed that it was still important to test basic student knowledge, but he wanted to try something different and felt that this would allow the subject to keep evolving:

> *We change probably just because I'm more comfortable with these kinds of things, but we still need to test the basic knowledge.... I want the students to try something a bit different, so there's no logical or technical reason behind that why I need to change, because I don't want to stay always the same.* (Ji, Beginning-of-Semester Interview, 2015)

Subject 700 had a total of 40 student enrolments. Ji reported that the subject was designed to run for one 13-week semester with one three-hour workshop each week. The three-hour workshop included a two-hour lecture and a one-hour tutorial. Lectures involved the transmission of knowledge from instructor to students and tutorials were based on analysing case studies. The subject was structured to include teaching from two university teachers: Ji, who taught the first half of the subject, and a colleague, who taught the second half.

The subject included four assessment tasks: a case study (20%, due in Week 4), a quiz (30%, due in Week 6), a methodology comparison (20%, due in Week 11) and a final quiz (30%, due in Week 13).

The case-study assessment required students to work in groups to review a case study and identify the appropriate system-development approach evident in the study. The next assessment was a quiz that assessed all the topics presented during Weeks 1 to 5. The quiz was two hours long and focused on advanced concepts, IT case-study analysis and business-system development. The third assessment was a 'methodology comparison', which required students to compare different methodologies. The final assessment was a quiz, which assessed all topics presented during Weeks 8 to 12. This quiz was two hours long and focused on the same areas as the first quiz (i.e. advanced concepts, IT case-study analysis and business-system development).

The case-study assessment and the methodology comparison were both submitted in hard copy. Students were not required to submit any work online; however, technology was used for students to create their assessments, as they were required to type it, for example, through the use of Microsoft Word.

4.4.3 About technology use

Ji spoke about the careful planning of technology in teaching and felt that the nature of each subject determined whether technology would be used and how it would be integrated. In his beginning-of-semester interview, Ji explained that technology integration was not central to the teaching of Subject 700:

> *The nature [is] a bit different. It's talking about the methodologies, [it's] not very practical. In that way, you don't have something like technology, you can get all the material from the internet. The tutor need[s] to lead [students] to think in the right way…that's why the discussion is more important, because if you ask them to present, they have nothing to present unless the students have been [a] manager or already developed some system in a company.... It's very abstract, so that's why they are different.* (Ji, Beginning-of-Semester Interview, 2015)

Lecture and workshop observations showed that technology was integrated into Subject 700. Examples included the use of Moodle and PowerPoint. These forms of technology were integrated to support student learning.

Example 1: The use of Moodle

Observation showed that Moodle was used in Subject 700. Subject material was uploaded to Moodle to support student learning. For example, Ji outlined that he would upload case studies to Moodle for students to download and read prior to attending face-to-face classes. Workshops (the tutorial component) would then be based on discussing the allocated case study:

> *Yes, our tutorials actually are many case studies. I give the materials in the earlier week, then the students are supposed to download that and read that and prepare the questions…with those materials. Then they come back in the next week, [and] we discuss together.* (Ji, End-of-Semester Interview, 2015)

Example 2: The use of PowerPoint

Observation showed that Ji used PowerPoint in Subject 700. He outlined that he used this tool as a visual support for student learning and to guide his discussion during lectures:

> *PowerPoint is a very common way nowadays, so I gave the dot points then tried to explain between the dot points what's happening there, what are the concepts there, what are the techniques, what are the methodologies.* (Ji, End-of-Semester Interview, 2015)

4.4.4 Reflections on teaching

In his overall reflection on the subject, Ji felt that Subject 700 went well. He based his overall evaluation on student attendance and Moodle:

> *I think it's pretty well...student attendance [was] quite good and we use[d] Moodle as the major platform.* (Ji End-of-Semester Interview, 2015)

However, Ji felt that his use of technologies in Subject 700 was disappointing. He noted that he used basic technologies in his teaching of the subject:

> *I would say maybe disappointing...that I use basic technologies nowadays...probably mentioned earlier before you started this. I said in my other subjects I use...technology-rich methodologies, like I develop some fresh video games to explain the concepts to the students.* (Ji, End-of-Semester Interview, 2015)

Even though Ji felt his use of technologies in Subject 700 was disappointing, he believed that the nature of the content had a large influence on how he could use technology in his teaching. He felt that the subject required a substantial amount of direction from the teacher, and thus it was difficult to use technology innovatively:

> *We want the students to be involved in discussions. It's not about we put online so there's a big argument...so a lot of subjects may be suitable.... The students learn by themselves, they have everything online.... They don't need the teacher's involvement, but for this subject I would say that [the] teacher's involvement or engagement with the discussions or give the guidance about this...is very important because all these methodologies or philosophy behind the concepts is sometimes difficult for the students to read by themselves, to learn by themselves.* (Ji, End-of-Semester Interview, 2015)

4.4.5 Themes that emerged

Overall, one key theme surfaced about Ji's use of technology in teaching: that the nature of one's subject area can influence the innovative use of technology in teaching.

Ji believed that the nature of one's subject area can have an influence on technology use in teaching. He expressed that technology use was not essential to the teaching of Subject 700, as the subject matter was too complex for students to engage with independently without direction from the teacher. Thus, he used traditional teaching methods to assist students in understanding subject matter. He identified his central role as delivering content to students and also in leading discussion about specific case studies. Overall, Ji did not believe that technologies could be used innovatively in his subject and identified the crucial role that context plays in determining whether teachers integrate technologies into their teaching or subsequently avoid their use.

Whilst, the above theme highlights the impact that content area may have on technology use in teaching, some questions have been raised about Ji's case. Specifically, whether Ji could have integrated more innovative technologies into his teaching and whether his TPCK was in fact limited. Although the below example shows Ji successful use of PowerPoint in the context of his subject, this is not a representation of his overall knowledge of technology use in teaching.

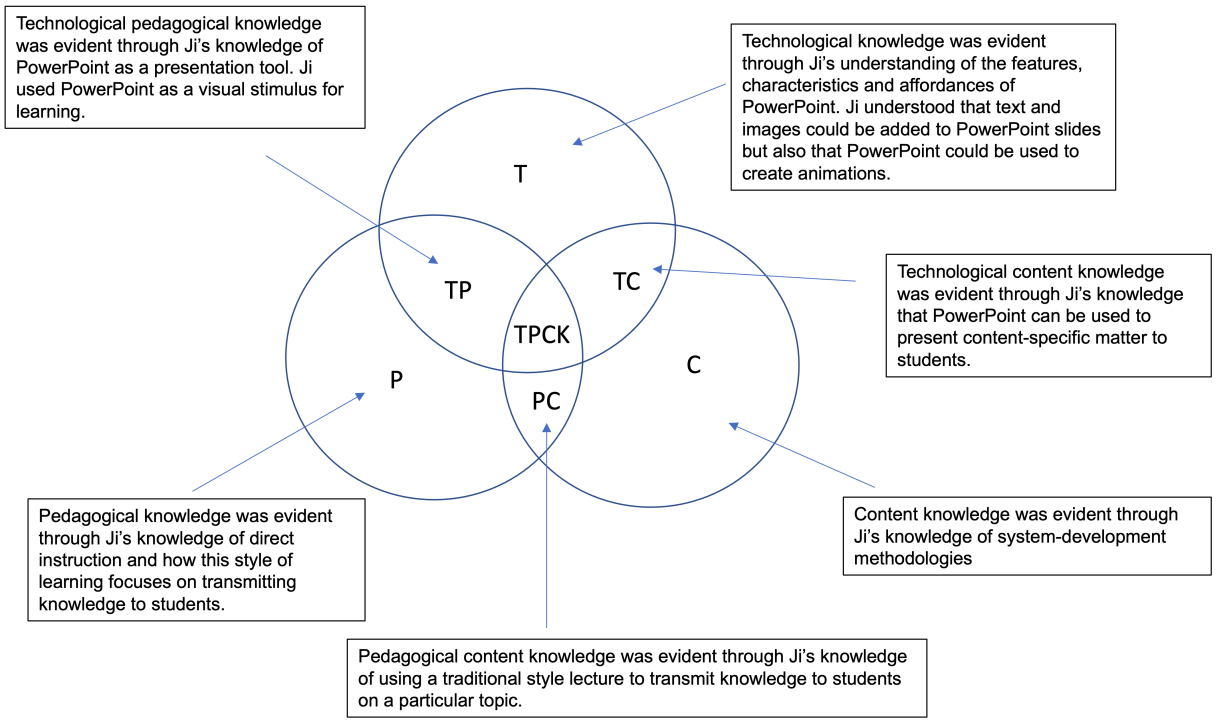
4.4.6 Discussion

In the following section, one example of Ji's use of technology is provided. This example is presented and analysed in terms of knowledge, self-efficacy and technology value.

4.4.6.1 The use of PowerPoint

Ji's technological, pedagogical, content knowledge was seen in the integration of PowerPoint in his teaching. During face-to-face lectures, PowerPoint was used to support the delivery of subject matter. Information presented on slides was summarised into dot points; this provided a visual support for student learning. An analysis of this example suggests that Ji was able to bring together his knowledge of technology, pedagogy and content to use PowerPoint effectively in his teaching. For example, he showed knowledge of content through an understanding of key concepts related to system-development methodologies. He further showed evidence of pedagogy through the use of direct instruction. Ji delivered a traditional lecture where he transmitted knowledge to students, who were passive recipients of information. Finally, Ji's knowledge of technology was seen in the use of the presentation tool PowerPoint. He understood how this presentation tool could be used in his teaching to support the delivery of content. Through knowledge in these three areas and their combination, Ji showed the successful use of PowerPoint in his teaching.

Below is a graphic representation of the knowledge domains found in Ji's use of PowerPoint in his teaching:



4.4.6.1.1 How self-efficacious was Ji in using technology?

The above example shows that Ji had a high level of self-efficacy when using PowerPoint in his teaching. His high self-efficacy was a result of continued use of the tool in his teaching over an extended period of time. Through continued use and exposure, Ji had the self-belief that he could use PowerPoint successfully in his teaching. This example links to Bandura's concept of mastery experience which highlights that repeated exposure and completion of a task can lead to heighten self-efficacy and a strong belief in one's ability to complete a specific task. In Ji's case, he had experienced continued success with PowerPoint, specifically with creating slides that included content and using the tool as a visual stimulus for learning, and this boosted his self-efficacy.

4.4.6.1.2 What value did Ji place on technology?

An analysis of the above example showed that Ji valued the use of PowerPoint in his teaching. PowerPoint was selected because it provided a visual support for student learning. Ji selected this basic technology because it did not distract students from the real business of learning, which was developing an understanding of content matter. The value that Ji placed on PowerPoint in teaching links to Eccles's construct of utility value. This concept was evident in the example because Ji saw the usefulness of the technology in providing a visual summary of important key content to students.

Overall, this example has shown that Ji was able to draw on his knowledge of technology, pedagogy and content to use PowerPoint in his teaching. Ji reported a high level of self-efficacy for this tool because he had used it previously in his teaching. Ji further valued the use of PowerPoint as it provided a visual support for student learning. This example highlights a relationship between knowledge, self-efficacy and value. Specifically, Ji had the knowledge to use PowerPoint in his teaching and this impacted the belief he had in using the technology. He felt a strong sense of self-efficacy for using PowerPoint in his teaching and the element of risk was minimal. The number of years he spent using the technology and also the success he experienced, would have both impacted his TPCK and self-efficacy within the context of using PowerPoint. His TPCK would have been strengthened and his self-efficacy could have been increased. Thus, multiple factors, such as years of experience and experimentation can both lead to a simultaneous impact on both constructs. What might be important to note is institutional value, PowerPoint is a tool that is frequently valued in higher education instutions. Ji highlighted that he valued the use of PowerPoint in his teaching, however, it would be interesting to know whether the value he had for PowerPoint and his belief that the tool could be beneficial for learning first started as a belief at an institutional level.

4.4.6.3 Conclusion

The above example provides evidence of Ji's use of PowerPoint in his teaching of Subject 700. Although Ji's interviews described his high technological knowledge, this was not evident in Subject 700. Ji integrated PowerPoint, a standard institutional technology, which acted as a support for student learning. Through the use of this presentation tool, traditional teaching and learning methods were evident and decisions surrounding Ji's technology integration in teaching were for the purpose of supporting student understanding of content.

4.5 Case 4: Richard –fourth-year undergraduate psychology subject

I'm training psychologists here so…what is…in my mind the whole time is that I'm entrusted with the training of people who one day are going to be sitting down with a real-life client…and I want to make sure they know how to do the job.

4.5.1 About Richard

Richard was a full-time Senior Lecturer in the School of Psychology. He had worked in the School for 19 years, firstly as a casual lecturer and then in a full-time capacity for seven years. Richard's expertise was in clinical psychology. He completed his PhD late in his career and, being in his 60s, had a previous career or life vocation as a Catholic priest, religious-education consultant and clinical psychologist at another Australian university. His passion was supporting young people's wellbeing. His research addressed childhood spirituality and the influence of mindfulness, wellbeing, hope and self-efficacy in coping amongst first-year university students.

Richard's teaching responsibilities focused on the undergraduate psychology program, specifically third- and fourth-year students undertaking a four-year honours degree. The subjects he taught addressed the application and assessment of psychological principles in the workplace. The third-year subject focused on the application of psychology in a number of clinical settings, such as health psychology, organisational psychology and occupational psychology. One of the main focuses of this subject was addressing the relationship between research, theory and practice. Case studies were an integral component of this subject, as they allowed students to analyse the application of psychology in the workplace. The fourth-year subject, which was the focus of this research, addressed how students undertake psychological assessment in a clinical setting, and develop skills in analysing and interpreting client cases, interviewing clients and using assessment applicable to their future profession. Both Richard's subjects focused on the practice of psychology and had relevance to students' future workplaces. There was an emphasis on developing student skills in both applying theoretical principles to practice and analysing and interpreting client cases to understand and explain client behaviour.

4.5.2 About the subject – principles and applications of psychological assessment

Richard was the subject coordinator of Subject 400, which was a four-hundred level honours subject offered in the School of Psychology. This subject was designed to introduce students to the principles and applications of psychological assessment, particularly how to undertake a psychological assessment in a clinical setting. The subject focused on the analysis of a child case study, methods of gaining information

from clients during an interview and the use of assessment tools, such as the Neale Assessment of Reading Ability (NARA) and Wechsler Intelligence Scale for Children (WISC-IV), to make a judgement and draw conclusions regarding child behaviour. The subject had a focus on developing student understanding of the need to respect professional principles when interacting with clients, such as client age, cultural background and issues related to psychological assessment. Richard explained that he designed the subject to have authenticity and relevance to real-world practice to give students a sense of how they would undertake psychological assessment as a practitioner:

> *I want them to be able to throw ideas around with each other, I want them to go away and to sit down and think about it and nut it out as they would in the workplace.* (Richard, Beginning-of-Semester Interview, 2015)

Richard first taught Subject 400 in 2014. This subject was introduced following the restructure of the fourth-year Bachelor of Psychology degree. Although there was a pre-existing psychological assessment subject available as part of the former Psychology degree, Richard explained that he had wanted to redesign the subject to include a stronger focus on real-world authenticity and the development of a collegial environment where students would consult with their tutor and peers to analyse and interpret a client case study.

Subject 400 had a total of 58 student enrolments. Richard said that the subject was designed to run for one 13-week semester with weekly one-hour lectures and two-hour workshops, in a face-to-face setting. He outlined how the subject was designed around a single case study of a boy named Dominique, who presented behavioural, emotional and academic difficulties, and his mother. Students were required to analyse and interpret the case throughout the course of the subject to make a judgement about and explain the child's behaviour. This case included multiple sources of assessment related to a child referral, such as video interviews between clinician and clients and psychological-assessment forms.

The lectures were designed to provide students with information about theory, specifically information about different forms of assessment for children, adolescents and adults, how assessment was undertaken and the moral, ethical and technical approaches to assessment:

> *My thinking behind that is, first of all, in my lectures it's purely giving information.... I see the lecture as fulfilling my responsibility to give them good quality – good, solid information about psychological disorders that require [psychological] assessment. I think ethically I've got a responsibility to do that.* (Richard, Beginning-of-Semester Interview, 2015)

Richard explained that the lectures were a way to help students develop foundational knowledge of psychological assessment and assist them in understanding the nature of how and why this process was undertaken in a clinical setting.

The two-hour weekly workshops were interactive and focused on students' applying their knowledge of assessment principles. The workshops focused on how to undertake psychological assessment in a clinical setting. They began with students receiving a referral made by Dominique's mother, who was concerned about his behaviour. The students viewed a number of prerecorded roleplay interviews of the clinician and his clients (Dominique and his mother) throughout the semester, which were specifically designed by Richard for use in the subject. From the fourth week onwards, students received completed physiological assessment protocols to review, with examples including a completed profile sheet of an intellectual assessment, a behavioural assessment and a self-assessment undertaken by the child. Richard said that these were introduced week by week, over the course of five weeks, where appropriate, to coincide with discussion and learning in the workshops.

Richard stressed the importance of the workshops being a place for students to share their ideas with colleagues ('colleagues' being a term he used to describe himself and peers, as he aimed to mirror a future workplace setting) and compare their interpretations of the referral, video and assessment items:

> *I want them to feel as if they can say to me, 'Look, I disagree with you. I might be the registered clinical psychologist but I'm a colleague amongst colleagues.' I want them to be able to throw ideas around with each other, I want them to go away and to sit down and think about it…as they would in the workplace.* (Richard, Beginning-of-Semester Interview, 2015)

Richard articulated that the reason for developing the workshops in this way was for the students to be involved in a collegial approach where they were required to trust their judgement, challenge their colleagues and reflect on their learning. He explained that he did not want students to be involved in a theoretical approach where they would be exposed to learning about instruments and completing a written assessment:

> *I could set them tasks…and they could come in with a written assessment every two weeks and I could mark that, and we could do other stuff like, well, let's have a look at the WISC-IV, let's have a look at this, let's play with that instrument.... What's that going to achieve? It's still a theoretically driven approach. I don't want a theoretically driven approach.* (Richard, Beginning-of-Semester Interview, 2015)

Richard clearly described how he wanted students to develop skills essential to working with and consulting with clients. He felt that it was his responsibility to design the subject in a way that would assist students in developing these skills:

> *I'm training psychologists here, so I guess what is ethically and morally in the back of my mind the whole time is that I'm entrusted with the training of people who one day are going to be sitting down with a real, life client and have that client's future well and truly in their hands. And I want to make sure they know how to do the job.* (Richard, Beginning-of-Semester Interview, 2015)

The subject included three assessment tasks: two-role play interviews (15% each: Recording 1 due in Week 5 and Recording 2 due in Week 10), a short-answer case analysis (20%, due in Week 7) and a child case study (50%, due in Week 12).

The 'role-play interview' required students to record and submit a 10-minute video of a role play they had created of a client and clinician, along with a two-page reflection on their experience. This assessment task required students to take on the role of clinician and illustrate what they had learnt from viewing and analysing the prerecorded interviews. As part of this assignment students were given a second attempt at creating their video after a 30-minute feedback session with their tutor. Following this, the short-answer case analysis gave students the choice of analysing a child or adult case study. Students had to make a judgement on what they felt was happening in the case and present their findings. Lastly, the child case study involved students presenting their analysis and interpretation of Dominique's case, which was the focus of the workshops for this subject. This final assessment task was designed for students to show their culminated understanding of the subject, specifically what they had learnt about analysing a child case and making a judgement regarding the behaviour of the child.

The short-answer case analysis and the child case study were connected, as they both required students to analyse and interpret the findings of a case study. The role-play interviews also tied in with the child case study, which involved students watching prerecorded video interviews of clinician and client and applying what they had learnt from watching the videos.

Technology was a central focus for the child case study and role-play interviews. Richard explained that the child case study used video to present interviews between client and clinician, whereas the role-play interviews required students to choose a tool of choice to create a video of a role play between clinician and client. For the interview assessment task, students needed to submit their assignment online; Richard then watched the recording with each student and participated in a feedback session regarding interview skills, addressing the student's strengths and weaknesses. Technology was also used to support students' completion of the short-answer case analysis, as a folder was made available to students on Moodle (see 4.5.3: Example: The use of Moodle) in Week 7 with the materials they needed to

complete their case-study analysis. Further, observations also showed that support materials were available on the subject's Moodle site (see 4.5.3: Example: The use of Moodle) to assist students in completing the child case study. A discussion space was also available via Moodle for students to collaborate with their peers and assist each other in the completion of assessment tasks.

4.5.3 About technology use

In Richard's beginning-of-semester interview, he stated that technology use in Subject 400 needed to serve a purpose, and that its integration depended on whether it would support and heighten student learning.

Richard stated that collegial discussions were important in his subject, and that Adobe Connect would be used during the semester to communicate with students and discuss questions they had about the subject. He explained that he wanted students to view him as approachable and wanted to allow them to feel as though they were working in a collegial environment.

Richard said that the technology allowed for student engagement. He felt that the use of videos in his teaching gained the attention of his students and allowed them to focus on course material:

> *There is the thing called 'Death by PowerPoint', and you can see students switching off before you've got through a whole lot of slides. You can actually see them switching off, and the minute you show something on the screen that's visual, bang, they're back on again. That's basically why.* (Richard, Beginning of Semester Interview, 2015)

Although Richard shared his ideas and plans for technology integration, he felt that his use of technology was limited, and that this was due to funding. He went on to describe simulated environments he had seen:

> *One of the biggest difficulties we've got in this university is not access to technology; we all have access to technology, but we don't have sufficient access to money to spend on technology. So, we might have all these great creative ideas, but the money is not there…. I've seen fantastic virtual workplaces where people are walking around…on the screen they can move a person…that's megabucks.* (Richard, Beginning-of-Semester Interview, 2015)

Lecture and workshop observations showed several ways in which technology was integrated in Subject 400. Examples included the use of Moodle, Adobe Connect, PowerPoint and prerecorded videos. These were integrated to support student learning, provide a means for communication and discussion around subject content and promote a collegial environment.

Example 1: The video case study

Richard described how the subject was designed around a virtual workplace where students watched prerecorded video interviews between a clinician and his clients, a young boy and his mother. This form of technology was central to the subject, and materials were designed around these prerecorded video interviews.

Richard was the clinician in these videos and the videos were available on the subject's Moodle site for students to watch after workshop if they wished. Even though time was allocated for watching the videos during workshops, these videos were not watched in their entirety. Instead, students would watch a section of the prerecorded video interview and discuss what they believed was happening with their teacher and peers.

The prerecorded video interviews were also used to model interview etiquette for the students. A subject artefact showed that students needed to use the understandings they had gained from watching the interviews to develop a recording of themselves undertaking an interview. This recording was then submitted as part of an assessment task, and a consultation was held during which the teacher gave feedback to the student about the interview. A subject artefact showed that this method of providing feedback to students on their recorded interview was used to support student learning, as they could then apply this feedback to a second attempt of the same assessment task.

Prerecorded video interviews were displayed during face-to-face classes on a projector. Thus, a classroom computer and projector were also involved in the showing of these videos.

Example 2: The use of Moodle

Moodle was used as a support tool in Subject 400. Richard explained how it was a university requirement to have an active Moodle site with a copy of an online document providing details about the purpose of the subject, contact details of the subject coordinator and tutors, a weekly timetable for lectures and tutorials, assessment details and rules and regulations regarding attendance and assessment. Observation showed that Richard provided this document to students on his Moodle site; however, he also undertook additional activities, such as uploading resources in the form of lecture slides, tutorial material and assessment protocols, making prerecorded videos available through Equella (a digital repository) and providing access to discussion spaces and Adobe Connect for students to discuss their ideas regarding subject content.

Richard said that a discussion forum was available on Moodle for students to discuss subject content:

> *First year that I've used the discussion site. Again, that was Todd [who] put me onto that. I tried not to be prescriptive about that site because I don't want students getting the idea that that's the only way they can use it. So, the students know that they could…post any questions on the site. One question I will post on the site is 'How are things going? How are you finding this workshop experience?' I'll look for those responses…. I want them to use the site…to throw ideas around about the Dom case and I want them to challenge each other.* (Richard, Beginning-of-Semester Interview, 2015)

Richard said that the use of Moodle provided an avenue for students to submit their assignments and thus reduced the time that he would spend collecting hard copies of the task:

> *I use Moodle for assignments. I use the Dropbox [available via Moodle] all the time, and the reason for that is that you haven't got the hassle of having to be here to accept assignments.* (Richard, End-of-Semester Interview, 2015)

Richard also highlighted that he used Moodle to provide assignment feedback to students. He explained how Moodle allowed him to upload verbal feedback files to students:

> *I also use Moodle to upload assignments when I've marked them. Now, Moodle is ideal this way; it's got a 200-megabyte upload and I use QuickTime player and Handbrake to give verbal feedback in my assignments. The students then get back the verbal feedback, they listen to it, [and] they can come and see me or contact me or whatever.* (Richard, End-of-Semester Interview, 2015)

Example 3: Adobe Connect

Adobe Connect was introduced into the subject to provide students with a way to communicate with the subject coordinator on a weekly basis during the semester from April 6 to June 27. These online meetings were scheduled to assist students in furthering their understandings of subject matter and course content. During Adobe Connect sessions, students could ask questions about the subject:

> *Here you can log in to a weekly meeting to discuss any concerns you have about the subject, content, and assignments. Your subject coordinator will facilitate these meetings and tutors will also be present (if available). Ensure your microphone is enabled (and webcam if you would like to be seen) by selecting the microphone button on the top bar (it will be green when enabled). If you have any questions, please post a "?" in the chat box and the facilitator will address you. If you wish to ask a question to a specific individual, add their name to the "?". Please be respectful*

of those speaking, avoid speaking over others, as this will interfere and cut off the speaker. (Subject artefact, Moodle Site, 2015)

Online observational data showed that Richard used Adobe Connect to support students' completion of the subject. Richard was available on a weekly basis starting from mid-semester for students to ask him questions about the subject. These questions could be about subject content or assessment tasks.

Example 4: Traditional lecture

Face-to-face observational data showed that Richard delivered a traditional lecture, where students were presented with information on key concepts regarding psychological assessment. A PowerPoint was used, and videos were incorporated into the lecture. The data suggests that Richard was in control of learning and knowledge was transmitted from teacher to students.

4.5.4 Reflections on teaching

Richard was happy with how the subject went and felt that it had run better than the previous year. He explained that this improvement may have been the result of an evaluation meeting, which invited students, tutors and colleagues at the end of the semester to comment on the subject, specifically what aspects of the subject worked and what still needed improvement:

> *I think it's gone better than what it did last year. Each year we adapt the subject by having an evaluation meeting with the students involved, okay, with the two tutors, my two fellow teachers, myself and students are invited to come…and in that evaluation, they give us suggestions about what worked and what didn't and what we might like to try next year.* (Richard, End-of-Semester Interview, 2015)

Richard's reflection described how students' interview skills were better than the previous year, as the assessment had been adapted to give students two attempts at conducting an interview. A feedback session was held between these attempts to assist students with the interview process, which he believed allowed students to refine and develop their interview skills.

In his final interview, Richard noted that the discussion space on Moodle could have been better used by the students, and he wanted to make this a priority for the following year:

> *They haven't actually used them a lot I've noticed this year. So, I'm going to push them a bit next year because they could have been using a lot more than what they did use.* (Richard, End-of-Semester Interview, 2015)

Richard said that students did not use the discussion space he created on Moodle, and that this could have been due to the competitiveness of the degree:

> *One of the ongoing problems we've got in fourth year is... [students saying,] 'I'm worried about getting the best possible marks.' …The students in fourth year struggle between actually learning for future work and getting the best possible marks to get into fifth and sixth year. I'm not too sure why they're not using the discussion space; ...[maybe] they don't want their good ideas to get out and everybody else [to] get hold of them.* (Richard, End-of-Semester Interview, 2015)

One of the points Richard elaborated upon in his interview was that students felt verbal feedback gave them an understanding of how to complete assignments in an alternate way:

> *It helped them understand alternative ways of doing parts of an assignment because I'll say, 'Look, there's a better way of putting this,' because doing it this way means that you don't fall into the trap of confusion. And, 'I found the way in which you wrote that slightly confusing to understand.' …And of course, the most obvious one that comes back all the time is, 'I can't understand your writing. You write comments, but I can't read your writing.' ...Whereas if it's spoken…they get 10 to 15 minutes of feedback on an assignment.* (Richard, End-of-Semester Interview, 2015)

Although students generally liked receiving verbal feedback, Richard described how his teaching evaluations showed that a student found this type of feedback challenging to hear:

> *Students found [verbal feedback] refreshing…. I had comments like 'I feel as if I'm in the room and you're talking to me…. I can listen to it and play it again.' …A further comment was, 'I found it challenging….' The difference is, if you get written feedback, you can interpret it any way you like, but if you get verbal feedback, you're actually hearing what the other person thinks and that can be a challenge.* (Richard, End-of-Semester Interview, 2015)

Richard felt that Adobe Connect was a great way for him to support students' learning. He said that starting from next year he would incorporate Adobe Connect into his subject on a weekly basis, and perhaps conduct student discussions in smaller groups. He also discussed how this change stemmed from wanting to mirror more of a workplace environment and expose students to the experiences they would be involved in, in this setting:

> *[A] sense of collegiality is really important, and by collegiality, I mean I might be their coordinator and I might be the person writing the subject and…marking their assignments…but, if I'm approachable, if I'm not giving over an air of superiority…they're going to feel more and more*

> *comfortable…. Now that's what it's like in the workplace. In the workplace, you get a client, that client is yours…. You get peer supervision, you run issues past your supervisor or your peers but apart from that, that's your client. You are responsible for that client.* (Richard, End-of-Semester Interview, 2015)

During his final interview, Richard said that he valued the use of videos in his teaching. He felt that through being involved in the video and taking on the role of the clinician, he was able to show students that in the workplace not everything will always go to plan, and that that is okay. He said that he saw students identify in their assessments that they could have possibly done better, acknowledge this and correct themselves. He therefore felt that the videos provided them with an understanding of how to carry out interviews, recover from mistakes and carry on as they will need to in a workplace environment:

> *Whenever I do a video of a role play of a client interaction – I never rehearse it; I always do it cold because that's how it is in the workplace. So, I also want them to see me making mistakes, I want them to see me struggling, I want them to see me not making sense of things because I don't want them to get the idea that a good clinician is a perfect performer…. In the second behavioural interview assignment, I noticed that a number of them in my group were making mistakes and then saying, 'Oh hang on a minute, I need to rephrase that,' and that's great. So that's a personal reason why, and…I say these things to them in lectures and workshops, but unless they actually see it in practice, I could be just saying it.* (Richard, End-of-Semester Interview, 2015)

4.5.5 Themes that emerged

Overall three themes surfaced about Richard's use of technology in his teaching: openness to technology use, the relevance of teaching and learning to students' future workplace and the use of discipline-specific technologies to support student understanding of how psychological assessment is undertaken in a clinical setting. These themes are elaborated below.

Richard's openness to technology use was seen in the inclusion of prerecorded videos and Adobe Connect in his teaching. Although Richard had never used these technologies in his prior teaching of Subject 400, this did not appear to dramatically affect his self-efficacy. He was willing to 'give technology use a go' and expressed that learning was part of professional practice. He spoke of how he would seek technical support to assist him with integrating new technologies in his teaching. Even though Richard had limited knowledge of new technologies, if these tools aligned with learning goals, he would source knowledge of how to develop or use these technologies in his teaching.

Richard believed that Subject 400 needed to have relevance to students' future workplaces, and created a virtual learning environment where students had to analyse a child case study. Students viewed a series of prerecorded video interviews between a clinician and his clients to draw a conclusion about the behaviour of a child. Therefore, Richard's subject targeted the development of skills needed in a collegial environment, where students would share and challenge ideas with their colleagues/peers, develop interview skills such as how to question a client and obtain information and present their judgement about behaviour. The importance that Richard placed on the use of these virtual experiences showed that context had a substantial impact on how technology was used in his teaching.

Richard believed that discipline-specific technologies were important to integrate in his subject to support student understanding of psychological assessment. Although the university provided a number of institutional technologies, such as Moodle, desktop computers and lecture equipment for online recordings, discipline-specific technologies were not always readily available for use. For example, Richard explained how he had seen a commercially available simulation program that showed an online virtual environment of a clinical workplace, which he wanted to use in his teaching; however, because funding was not available, he could not. To address this, Richard attempted to develop a virtual environment through creating prerecorded videos of a clinician interviewing a client. He sought technical support from Todd to create these videos.

4.5.6 Discussion

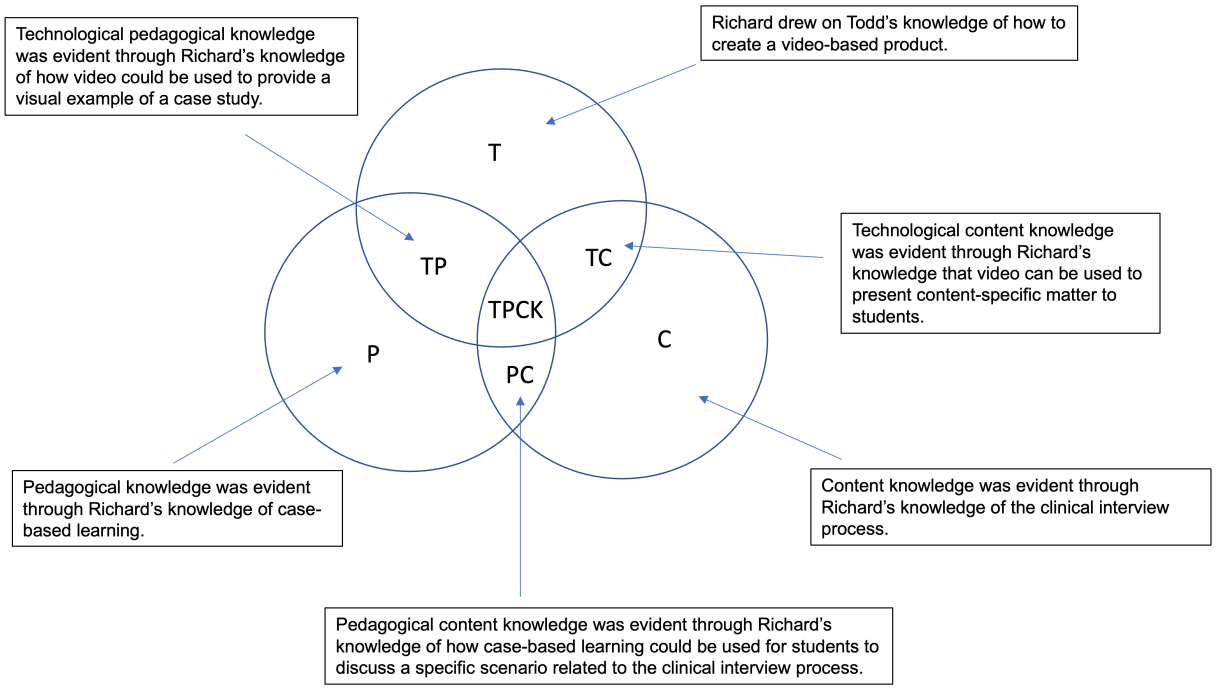
The following section provides two examples of Richard's successful integration of technology in Subject 400. These examples are presented and analysed in terms of knowledge, self-efficacy and technology value.

4.5.6.1 Video-based teaching materials

Video-based teaching materials were a central component to the teaching of Subject 400. As outlined above, Subject 400 was designed around a single child case – Dominique (and his mother) – who presented behavioural, emotional and academic difficulties. The child case study involved the use of video-based teaching materials that were introduced to students in tutorials. Snippets of these videos were viewed during class time and then discussed. In these videos, Richard played the role of the clinician, with the aim of using video technology to model to students the clinical interview process, as well as to illustrate how interviews could be used to assist a practitioner in drawing conclusions about a client's behaviour. An analysis of Richard's use of video-based teaching materials showed that he was able to bring together knowledge of technology, pedagogy and content to use video to assist students in understanding the interview process and the purpose of assessment in clinical psychology. For example, Richard used his knowledge of content; specifically, principles associated with interviewing a client in a clinical setting and knowledge about how interviews can inform a practitioner's understanding of their

client's behaviour. Richard also drew on his knowledge of pedagogy, through the use of case-based learning, where students were introduced to Dominique's case in class. During class-time students analysed particular sections of Dominique's case by participating in small-group and/or whole-class discussions. Through this learner-centred approach, students built their knowledge and worked together to present an interpretation of the case. Technological knowledge was seen in Richard's use of the presentation software: video. Richard sought assistance from Todd (technical support), as he did not know how to confidently use video to create the video-based teaching material. Through working with Todd, Richard furthered his understanding of video and successfully developed a real-life digital example of the clinician-client interview process to show students during class (and also make available on his subject Moodle site). Therefore, in terms of TPCK, this example shows that colleagues worked collaboratively to use their collective knowledges – Richard's knowledge of content and pedagogy and Todd's technological knowledge – to allow the task to be successful. Consequently, through working with Todd, Richard's knowledge surrounding the affordances of video was expanded. When knowledge in all of the three areas of TPCK were combined, an integrated knowledge base was evident, as Richard was able to present a technological product that he used successfully in his teaching of Subject 400.

Below is a graphic representation of the knowledge domains found in Richard's use of video in his teaching:



4.5.6.1.1 How self-efficacious was Richard in using technology?

Analysis showed that the time Richard spend working with Todd and preparing the video-based teaching materials allowed him to feel certain that they would work effectively in his teaching. Thus, Richard's case showed that preparation was a key factor influencing self-efficacy. Prior to the semester, Richard worked with Todd to design and develop the prerecorded videos and place them on the subject's Moodle site. Once Subject 400 begun, Richard displayed a high level of self-efficacy because the video resources had already been developed and Richard knew when and how they would be introduced to students during class. Overall, this shows that Richard's self-efficacy in this instance was constant during the course of the semester. Analysing this example, it is clear that a source of self-efficacy influencing Richard's use of video-based teaching materials was vicarious learning. Through Todd's support and demonstrations, Richard's self-efficacy increased for the use of videos in his teaching and he felt that the use of this technology would be successful in his teaching.

4.5.6.1.2 What value did Richard place on technology?

An analysis of Richard's case showed that he valued the use of video-based teaching materials in Subject 400 because students were able to visually observe how an interview would be conducted between a clinician and their client. This provided students with access to a real-world clinical context that aided their understanding of subject matter and future professional practice. Further, Richard saw how successful an online simulation could be through witnessing another program in action. He felt it was also important to integrate a similar learning environment into his teaching, and although he did not have the funding to use the same simulation, he developed prerecorded videos (with Todd) to ensure that students could be involved in a similar experience. Thus, the value that Richard placed on video-based teaching materials in his teaching links to Eccles's construct of utility value. This concept was evident in the above example because Richard believed that video role-plays are an effective method for student learning.

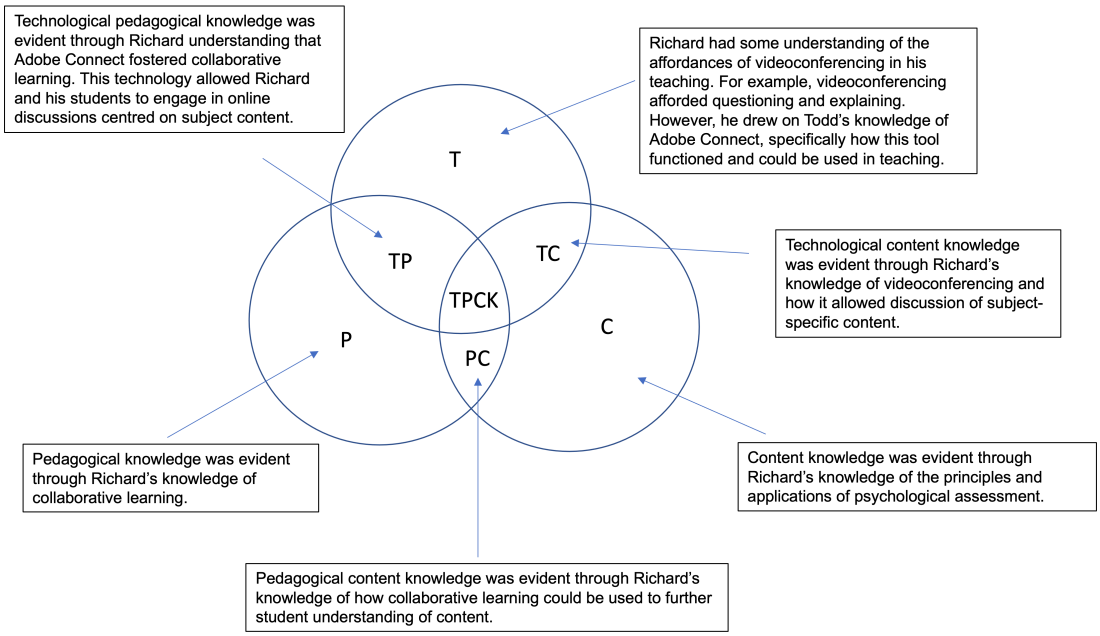
Overall, this example has shown that Richard was able to draw on knowledge of technology, pedagogy and content to successfully integrate video-based teaching materials into his teaching of Subject 400. Although Richard had to draw on Todd's technological knowledge to create the prerecorded videos, this did not appear to dramatically influence his self-efficacy. Instead, Richard had a constant level of self-efficacy throughout the subject. Richard also valued the use of video-based materials in his teaching, as he believed it was important that he prepare students for their future professional practice and that this could be achieved through an online virtual environment. Thus, through Richard's example it is clear that a relationship exists between value, knowledge and self-efficacy. Richard valued the use of role-plays in his teaching and wished to use video-based teaching materials to depict a clinican interview between a clinican and client. However, Richard assessed that he did not have the technological knowledge to complete the task and sought assist from Todd. Given the institutional support that Richard obtained to

supplement the technological knowledge that was missing from his TPCK, Richard was comfortable in using video in his teaching. He worked with Todd prior to the semester to ensure all videos were created and thus, this also contributed positively to his self-efficacy.

4.5.6.2 Use of web-conferencing

Another successful example of Richard's use of technology in teaching was Adobe Connect. Richard indicated that he wanted to use Adobe Connect to create a collegial environment where students could ask him subject-related questions. An analysis of Richard's use of Adobe Connect showed that he brought together his knowledge of technology, pedagogy and content to use this technology. For example, he used his knowledge of content – specifically, principles related to subject matter – to answer student questions. Richard also drew on his knowledge of pedagogy in his use of collaborative learning. Students were able to engage in a discussion with Richard and discuss questions related to Dominique's case and subject-related content. Through collaborative learning, students built their knowledge and developed an understanding of the content presented in the subject. Richard also believed that collaboration allowed students to get a sense of their future workplace environment and the practices that they would engage in. Technological knowledge was seen in Richard's use of the presentation software: Adobe Connect. Richard's TK in this area was developing, and Richard relied on Todd's assistance to develop an understanding of Adobe Connect and how it could be used in his teaching. As a result, when knowledge in all of the three areas of TPCK were combined, an integrated knowledge base was evident, as Richard was able to use Adobe Connect successfully in his teaching of Subject 400.

Below is a graphic representation of the knowledge domains found in Richard's use of videoconferencing in his teaching:



4.5.6.2.1 How self-efficacious was Richard in using technology?

Through seeking support from Todd, Richard demonstrated his belief that Adobe Connect would work successfully in his teaching. Richard maintained a positive self-belief in his ability to use Adobe Connect, even though he had never used this tool previously in his teaching. He valued its use for student learning, and this allowed him to presevere with the use of the tool. His end-of-semester interview highlighted that he would use Adobe Connect again in his teaching. This example links to Bandura's concept of vicarious learning. Vicarious learning influenced Richard's self-efficacy because Todd modelled the use of this tool to Richard and showed Richard how the technology could be used in his teaching. This process allowed Richard to feel more self-efficacious about the use of Adobe Connect in his teaching.

4.5.6.2.2 What value did Richard place on technology?

Analysis of the above example showed that Richard's use of Adobe Connect was driven by the value he placed on using technology to foster the skills his students would need in their future workplace, such as communication skills, problem solving skills and decision-making skills. He was aware that collegial discussions were important in the workplace and believed that through the use of Adobe Connect he could engage students in meaningful discussions with himself as a colleague, and replicate peer discussions that occurred in a clinical setting. Thus, the value that Richard placed on Adobe Connect in his teaching links to Eccles's construct of utility value. This concept was evident in the example because Richard saw that the tool would foster collegial discussions, an important aspect of the workplace.

Overall, this example has illustrated that Richard was able to successfully use Adobe Connect in his teaching. This example shows that Richard drew on support from Todd (specifically Todd's technological knowledge) to learn about and complete the task. Through working with Todd, Richard maintained a positive attitude towards using Adobe Connect. He valued students engaging in activities relevant to their future professional practice, and this drove the use of Adobe Connect in his teaching. Thus, through Richard's example it is clear that a relationship exists between value, knowledge and self-efficacy. The more that Richard used Adobe Connect throughout the semester, the more that his self-efficacy grew. The value that Richard displayed for the tool allowed him to perservere with its use even though his technological knowledge was limited,

4.5.7 Conclusion

The two examples above provide evidence of how Richard effectively embedded video-based teaching materials and Adobe Connect into his teaching. Analysis showed that Richard used video-based teaching materials to create a virtual environment that allowed students to view the interview process between clinician and client. Adobe Connect was used to provide students with the opportunity to ask subject-related questions. Richard used this tool to allow students to engage in discussion with him (e.g. collegial discussion), which was a task they would complete in their future profession. Richard displayed a high level of self-efficacy for using video-based teaching resources, as they were developed prior to the semester. He also maintained a positive belief towards the use of Adobe Connect, although he had not previously used this tool in his teaching. Todd's technical support influenced Richard's self-efficacy. Overall, Richard's value drove his use of technology in his teaching. He believed that the real business of teaching was to prepare students for future professional practice. To do this, technology integration was imperative.

4.6 Case 5: Arabella – postgraduate educational technologies subject

It's not about the technology. It's about what you're teaching and how you're teaching it.

4.6.1 About Arabella

Arabella was a full-time lecturer in the School of Education. She taught English as a second language to postgraduate students and had worked in the school for five years. Arabella's interest in Teaching English to Speakers of Other Languages (TESOL) arose from her involvement in international teacher-exchange programs: specifically, a program in Japan where Arabella worked in a junior high school for three years as an assistant language teacher and a teaching position in China, where she taught English to adult learners. Prior to Arabella's full-time employment at the university, she worked as a researcher in TESOL and an editorial assistant, and taught English as a Second Language (ESL) to undergraduate and postgraduate students sessionally. Arabella was the School of Education's on-campus TESOL coordinator and Head of Postgraduate Studies for coursework students. These roles involved her overseeing student enrolment and staffing allocations for TESOL subjects, as well as the evaluation of subjects to ensure that the Australian Quality Framework was effectively implemented across all TESOL subjects.

Arabella's teaching responsibilities focused on two subjects that she coordinated in the Master of Teaching program. The first postgraduate subject addressed the use of technologies in second-language teaching, introducing the selection, development and examination of technologies. This subject presented an analysis of technologies and their relevance to the curriculum, as well as the role of educators and learners in the use of technologies. The second postgraduate subject addressed oral communication and methods for teaching, learning and assessment. This subject introduced students to the nature of speech, the difference between oral communication and written expression and methods for assessing oral skills. It addressed spoken-language outcomes in the curriculum and the role of speaking and listening in second-language literacy.

4.6.2 About the subject – teaching postgraduate students the principles and applications of technology use in ESL classrooms

Arabella was the subject coordinator of Subject 900, which was a 900-level subject offered in the School of Education. This subject was designed to provide students with an introduction to technologies in second-language teaching. The subject introduced students to the selection, development and examination of technologies and further focused on addressing knowledge about print-based and

computer-enhanced language learning. The subject had a clear focus on computers and the development of effective learning environments for ESL students.

Arabella first taught Subject 900 in 2013. Prior to Arabella's appointment as subject coordinator, the subject had been taught by another academic in the School. All pre-existing subject material had been passed onto Arabella to use in her teaching. In her beginning-of-semester interview, Arabella explained how she gradually made modifications to pre-existing material each semester:

> *Over time, I've either completely revamped the subject; depends on who taught it before because if there's somebody pretty competent and solid who'd done it then you just keep using the same…but at this point now a lot of things have kind of slowly changed. The original content, there's still that in there but as each semester unfolds I usually try to tweak a few things, change a few things, so it's slowly becoming more and more mine. But there's elements of previous versions as well.* (Arabella, Beginning-of-Semester Interview, 2015)

Subject 900 had a total of 14 student enrolments. Arabella said that the subject was designed to run for one 13-week semester, with one three-hour workshop each week. These workshops were a combination of lectures and tutorials. The workshops included the delivery of key concepts through a traditional lecture approach, as well as practical components, where students would participate in activities centred on lecture content and key ideas presented in the subject.

The subject included four assessment tasks: evaluating teacher resources (20%, due Week 6), a paper on the affordances and implications of technologies in a chosen educational context (20%, due Week 9), an online discussion task (15%, due weekly) and the design of a Webquest (45%, due Week 13).

The teacher resource evaluation focused on students developing a blog using the educational tool Weebly. This blog focused on students' recommendations of a number of teaching resources to their peers. The teaching resources students were required to evaluate included one textbook and four websites that focused on a specific area of language (grammar, vocabulary) or skills (listening, reading, speaking, writing) to a particular group of students. Once students had completed the task, they needed to post the URL for their Weebly to a discussion Forum on Moodle and invite their peers to view the blog. Following this, students individually wrote a paper that addressed the teaching and learning values of an emerging technology, its affordances and its implications for learning in a chosen educational context. Assessment 3, the online discussion task, focused on students' participation in weekly discussion forums based on subject content. Students needed to share, interact and exchange thoughts based on weekly lecture material and subject readings. Students were also invited to ask questions and provide comments to their peers. Lastly, the Webquest focused on students creating a Webquest lesson in PowerPoint to upload to their Weebly site. The students needed to also write an essay that addressed their design

rationale, with a focus on how the project supported language learning. Students then needed to present their Weebly to the class in Week 13.

All assessments involved the use of technology. Assessment 1 and 4 included the use of Weebly. Students needed to create their Weebly for Assessment 1 and use the same Weebly for Assessment 4. Assessment 4 also included the use of PowerPoint, which students used to create a Webquest. Assessment 3 required the use of online discussion forums on Moodle, and Assessment 2 and Assessment 4 involved students using Microsoft Word (or a similar word-processing program) to create their essays.

4.6.3 About technology use

Arabella noted that there was an expectation that technology was used in her teaching. This requirement was part of university policy: academics were required to have a Moodle site that contained a copy of their subject outline:

> *You must have a Moodle site for your subject and your subject outline must be on it. Those would be probably the two mandates but with that, they would expect you to do something with it.* (Arabella, Beginning-of-Semester Interview, 2015).

She further said that the university wanted her to merge distance and on-campus subjects. However, Arabella highlighted that she was reluctant to do this as there was a large investment of time required:

> *They would like me to merge my distance and on-campus subjects so that basically I use Echo and I have my video stream on there or something, or lecture basically there. But I'm reluctant to do it because there's so much investment. The tutors we've had for five, six, 10 years, depending on who they are, they've invested so much time and energy into the construction of their sites.* (Arabella, Beginning-of-Semester Interview, 2015)

One of the messages Arabella conveyed during her beginning-of-semester interview was the need for students to understand the pedagogical reasoning behind technology use:

> *[Something] I really [try to communicate to] them is it's not about the technology, it's about what you're teaching and how you're teaching it, and can they learn effectively if you are using technology? Because so often, they think, 'Oh, let's use the technology.' Well, yes, but only if there's a pedagogical reason to do so. I'm trying to get them right now away from 'Okay, let's use technology for the purpose of just using technology' as opposed to thinking…or instead I want them to think that 'Oh, how will this technology help me to teach this better?'. We're kind of just*

working on that idea right now, and now it usually takes several weeks to get through until they really understand it. (Arabella, Beginning-of-Semester Interview, 2015)

Arabella believed that technology needed to be integrated into her subject because she felt that students needed to be introduced to technology-based tools they may never have heard of:

Part of what I want to do is just introduce them to potential. So, their second assignment focuses on 'Choose a technology'. By then I've gone through several technologies or they've come up in some way – discussion or their readings – and I say, 'Choose one of them, it doesn't matter what it is, and do a bunch of research on how it's used in society and how you might use it in teaching.' So, from that respect, I want them to find something they really want to learn about and explore its uses. (Arabella, Beginning-of-Semester Interview, 2015)

Arabella believed it was important for students to interact with one another and develop an online community. She also felt that, given that students were completing a technology subject, they should be interacting online. She explained that the student dynamic in her class also influenced her decision to use online discussion forums. She felt that through an online forum, all students, especially those who were quiet in class, would have the opportunity to discuss their thoughts on a particular topic area:

I want them to actually interact with each other, read each other's comments and respond to them so [they] have that sense of online community. And I do that because you'll have the students in class – well, one's the technology class so, I figure you should play with it a bit here – but the other part is [that] there's always students in class who will just speak, and they're usually very dominant, and the ones who are quieter – and especially when it's [that] 75% are international, and they might be from countries where they really don't speak English very much – they don't have a chance to speak. But with an online forum, they don't have to think on their feet, they can think what they want to say, they can take as long as they want to write something and it builds their confidence. So they get to share their ideas, even if it's not in the classroom. They can share it online and people can say, 'Oh you have some really good ideas.' (Arabella, Beginning-of-Semester Interview, 2015)

Arabella noted that although in the past she had received criticism from some students about the completion of a weekly discussion space, this did not prevent her from using forums. She wanted to create a comfortable learning environment and believed it was important for students to be accepting of all learning and communication types:

I tried to open up their eyes to the fact that – well, there's some students who just…they're not comfortable speaking in class, and it's not good enough to say, 'Well, they should. Why can't

> *they speak in this other forum?' So, we can cater to different types of learning and communication types, so that requires all of us to adjust. So, we're working on that idea.* (Arabella, Beginning-of-Semester Interview, 2015)

Lecture and workshop observations showed that technology was integrated into Subject 900. Examples included the use of Moodle and ICT tools such as YouTube, Weebly, Survey Monkey and PowerPoint. These forms of technology were integrated to support student learning, provide discussion about subject content and give students opportunities to create using ICT.

Example 1: The use of PowerPoint

Observation showed that Arabella used PowerPoint in her teaching of Subject 900. Her PowerPoint slides were uploaded to her subject Moodle site. She explained that PowerPoint was used mainly to support her international students' understanding of content, especially because they found it difficult to comprehend what she was discussing in class. Arabella's PowerPoint slides were available on Moodle for students to access, which allowed these students to easily go back and have a look at the key ideas in her presentations:

> *I use them as kind of a help piece...particularly with my international students, because they won't always understand what I'm saying. And so I like to have something written as a backup for them, so [that] even if they can't understand what I'm saying, they can get some of the main points.* (Arabella, Beginning-of-Semester Interview, 2015)

Example 2: YouTube, web searches and Slowmations

Face-to-face observations showed that Arabella also used YouTube videos, audio components, web searches and Slowmations in her teaching. Although Arabella did not complete a Slowmation during the subject, she felt it was important that students were aware of how technology could be used. During her beginning-of-semester interview, Arabella outlined that she incorporated YouTube clips into her teaching to allow her students to view another person's way of teaching and to critique the way in which something was taught:

> *I might put YouTube in there and use it as a discussion point as well. If it's a snapshot of somebody teaching something, we might do a critique of how she taught something or how he taught something, and [ask], 'Why do you think he did this?' or 'What points did you think were really, really good or useful about how this was taught?'* (Arabella, Beginning-of-Semester Interview, 2015).

Example 3: Discussion forums

Online observations showed that Arabella used online discussion forums in her teaching. She explained that forums were used to get students to share their experiences about an article and make connections to teaching in their context:

> *All I did was say, 'Here's the article. Say what you want about it,' and some of them – they're interesting because they went way beyond what I ever asked them to do. And I said several times in class, 'Twenty to 30 words is fine. It's only worth 18%.' But some of them came in and they'd give a summary of the article and then they'd post ideas. They got really engaged with that, and I wasn't sure, because it didn't take off that well last session, but this session, it just did.* (Arabella, End-of-Semester Interview, 2015)

Arabella said that she integrated discussion forums into her teaching because it was a tool that she was familiar with. She also incorporated discussion forums into her teaching because she wanted students to experience using a tool that they could potentially use in their future professional practice:

> *I thought, you know, it's a technology subject. They should use technology in other ways. So, for me, using the discussion forum made sense so they could experience something that they might have their students do.* (Arabella, End-of-Semester Interview, 2015)

Example 4: The use of Moodle

Arabella used Moodle in Subject 900 as a place to upload lecture notes, collect students' assignments through Turnitin and keep track of students' discussion posts:

> *The Moodle site for me is just a way for doing the discussion forums and for me providing lecture notes. Most of what I do is done in the classroom...I just put my lecture notes up there because they want them, yeah, and then the Turnitin assessment submissions. That was my first time using Turnitin, was this semester, and that seemed to go okay. I had some issues with making sure you set the criteria and do all the settings right. One time I screwed it up a bit – so be it, I can't remember what I did but it didn't end up being the way I wanted it to be, but that's all right. With the Webquest I found out, oh, you can't actually post your PowerPoint to the Turnitin site; it's one of the few things that you can't actually put into Turnitin, so I had to go and create…because I have one or two students who also want[ed] to submit early, and so they went in, [then told me,] 'I can't post my PowerPoint,' So I went in [and said], 'Oh, no, it won't take PowerPoint, will it? Okay, fine. So I had to then create a new Moodle submission just using the regular one, and that's fine, put it on there.* (Arabella, End-of-Semester Interview, 2015).

Example 5: Weebly

Online observation showed that Arabella used Weebly in her teaching. Weebly was used to create a class blog and for students to create their own blogs, which directly linked to the assessments in this subject:

> *I used it for the blog, so the first half of the semester, [and then] they went and created them, and I got good feedback from them about using blogs.* (Arabella, End-of-Semester Interview, 2015)

Weebly was used for the first time in Subject 900. In the past Arabella had used Blogger, but it was unreliable and, at times, time-consuming. She explained that she decided to use Weebly because it was much easier for the students to use and had fewer issues:

> *In the past I've used Blogger and just trying to get them signed in, signed up, I'd waste 10-15 minutes because this wouldn't work, who knows what reason. I couldn't explain it and then suddenly it might work or suddenly it just never did. That happened last semester. I just always plan for technology to fail, and then I've got a backup plan and then come in with it. But Weebly, it was so nice. I had 16 students who logged on, created an account, created the pages and there was minimal fuss, which shocked the heck out of me. I was so happy because for the first time, something I really want[ed] to use was just plain easy [so] that they could do it.* (Arabella, Beginning-of-Semester Interview, 2015).

Arabella also said that Weebly was for students to create their own website and be able to have something tangible to take away from the subject as opposed to traditional written paper:

> *I had been thinking about the idea of having students create their own website and then being able to take something tangible – virtually at least – from the course, because normally you write a paper and that's the last thing you ever see of it, but I wanted them to take something away from this and create their own website.* (Arabella, Beginning-of-Semester Interview, 2015)

Example 6: Survey Monkey

Online observation showed that Arabella provided students with access to Survey Monkey on Moodle:

> *It kind of goes with my 'Let's try to use as much technology as we can'. So everybody uses Survey Monkey, but I thought, 'We can use it for this too.' They had the option, if they really want[ed] to, to create their own Survey Monkey as part of their Webquest. I don't think anybody did that this semester, but they could have.* (Arabella, End-of-Semester Interview, 2015)

4.6.4 Reflections on teaching

Overall, Arabella felt that the subject had gone well. She was happy with how students had engaged with discussion forums, and highlighted that she was impressed with the sharing of ideas on these forums:

> *I think the subject seemed to go fairly well. The discussion forums that I did actually were amazing in…I haven't seen this before; I started doing it last semester but this semester they really took off to a place where I didn't think they would do. I thought students would go and do their posts and that would be it, but they seemed to just – not all of them, but many of them – seemed to enjoy bouncing ideas off of each other and sharing ideas about how to use technology or introducing new technology or websites or experienc[ing that what] works in their country may not work in another country.* (Arabella, End-of-Semester Interview, 2015)

Arabella said that no student complaints had been made in regard to the discussion forum(s), although she had experienced complaints the previous year. She had reflected on the feedback provided in 2014 and approached discussion forums differently in 2015 by inviting students to share their experiences and ideas:

> *Nobody, as far as I'm aware, had any complaints about the forums. I had complaints about the forums in the previous semester because students thought, 'You know, we're just going and repeating what other people have said.' That's not what happened this semester. This semester they said, 'No, it's new ideas,' and they liked it. And I think part of it is because I took on board the feedback from last semester, and I said at the beginning this time, 'It's not about just posting ideas and just doing the assignment; it's about sharing, because some of you are experienced, some of you are inexperienced, some of you are from Japan, some are from Australia, so you all have a different, unique perspective.' I think beginning the semester with a statement like that kind of made them think about it a little bit. I don't know if that's why it took off the way it did; it took off the way it did for whatever reason, but I think it helps me saying 'This is your place to share your ideas', and it seemed to work. That was good.* (Arabella, End-of-Semester Interview, 2015)

Arabella outlined that this was the first year she had used Turnitin. She explained that it was a mandatory university requirement that students submit their assignments online. She felt that she didn't completely agree with this process, and that it did not always make a university teacher's job easier:

> *Well, part of it is the university mandate to do online submission and put more and more online. I don't completely agree with that. In some ways, despite what people say, it doesn't necessarily make your job easier; it makes it easier to track but it doesn't make it easier to do. Now [for] some people I'm sure it does, because they've got students that comment...and that's fine, that works*

> *great for them. But sometimes I get very tired of sitting in front of the screen, and I'd much rather – which I've done – take my entire bundle of papers and I go to a park, and I mark them there where I'm away from technology, which only distracts me. But this year, I thought, 'You know what, let's try something new. Let's try Turnitin,' because one of the things that I find very aggravating, although I like doing paper-based tick, tick, tick and I find it a little bit better, I have a large number of international students and their understanding of issues related to plagiarism are not always ideal. And so, I'm very good at detecting plagiarism myself because I used to be an assistant editor for TESOL Quarterly and – not that I was trying to detect issues there – but some things would come up and so I'd have to deal with that.* (Arabella, End-of-Semester Interview, 2015)

One of the reasons Arabella wanted to use Turnitin was that it assisted students' understanding of plagiarism, and she felt that this was especially beneficial for international students. She explained how students could access their work multiple times before the deadline:

> *So with this, with Turnitin, at least it goes and tells me, 'Well, this is the same as here,' and most cases, it's just because they've copied something that's been okay to be copied so I haven't had a problem with that, but what I like, though, is with Turnitin, up until the submission deadline, they can check their report – 'Oh, there's a lot of similarities. Let's go change this.' So they have the opportunity to change it and change it and change it until at least it's something that they've written; to what extent…. You know, it doesn't take much to change a few words here and there, but at least this is probably one of the first semesters where I haven't had to call a student in for plagiarism. So, from that perspective, that makes me very happy.* (Arabella, End-of-Semester Interview, 2015)

Arabella also liked using Weebly in her teaching, and believed that her students also enjoyed using it:

> *So, to me that was great because it's very user-friendly, I think they enjoyed it. I kind of had hoped that they would use it to post their Webquest as well.* (Arabella, End-of-Semester Interview, 2015).

4.6.5 Themes that emerged

Three overall themes surfaced about Arabella's use of technology in teaching: she integrated technology into her teaching to address her subject's focus, she used discussion forums as a way for all students to actively engage in learning and she maintained a positive attitude towards using new technology-based tools in her teaching. These themes are elaborated below.

Arabella emphasised the importance of technologies in her subject because they focused on technology use in an ESL classroom. Arabella believed that students needed to be exposed to experiences that would assist them in their future profession; this was one of the driving factors influencing her integration of technology in Subject 900. Arabella expressed that her teaching needed to be underpinned by curriculum documents and best practice. Therefore, she designed workshop and online activities to align with ESL teacher standards and reflected on previous teaching to include a new tool, Weebly, in her teaching.

Arabella believed that the use of online discussion forums gave all students an active role in teaching and learning. In her past teaching, she found that in face-to-face classroom settings some students would dominate discussions, and this affected all students' engagement and participation. Therefore, through the use of online forums, Arabella gave all students an active voice to share their ideas and experiences. Arabella also reflected on her past evaluations of the subject to improve how she used discussion forums in her teaching. This example further illustrated how reflection allowed Arabella to refine her teaching to better suit her students.

Arabella highlighted that she had a high level of self-efficacy for technologies that she regularly used in her teaching. Although she had not previously used Weebly in Subject 900, she maintained a positive attitude towards the use of this tool. Arabella's willingness to experiment using Weebly was evidence of her openness to technology. This openness was a result of wanting to create a highly supportive learning environment, which included easy to use, reliable technological tools.

4.6.6 Discussion

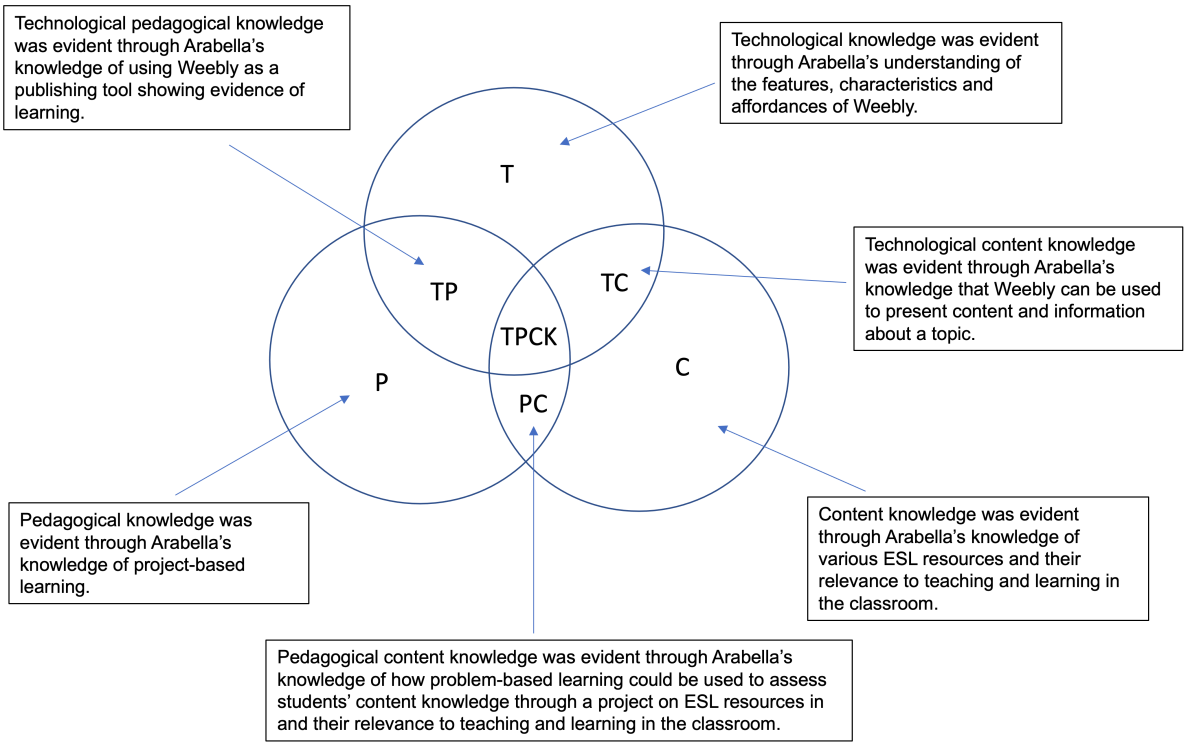
The following section gives two examples of Arabella's successful integration of technology in Subject 900. These examples are presented and analysed in terms of knowledge, self-efficacy and technology value.

4.6.6.1 The use of Weebly

Arabella's technological, pedagogical, content knowledge was seen in her use of Weebly. Assessment 1 involved the use of Weebly and students had to create a website evaluating teacher resources. As part of this assessment, students had to post the URL to a discussion forum on Moodle. Class time was also dedicated to students creating this resource. An analysis of this task showed that Arabella brought together her knowledge of technology, pedagogy and content to use Weebly to engage students in a reflective task that allowed them to critically evaluate the use of resources in an ESL classroom. For example, Arabella showed knowledge of content, specifically in the area of learning in an ESL classroom and educational design for an online learning environment. Arabella further showed evidence of pedagogy through project-based learning and reflective learning. Project-based learning was evident in

that students were given a problem that they needed to solve. They needed to create an overall website to share with their classmates. Reflective learning was also evident, as students had to reflect on the resources they had found. Finally, Arabella's knowledge of technology was seen in the publishing software Weebly and the process students needed to be able to follow to create a website. Through knowledge in these three areas and their combination, Arabella showed evidence of TPCK in her teaching.

Below is a graphic representation of the knowledge domains found in Arabella's use of Weebly in her teaching:



4.6.6.1.1 How self-efficacious was Arabella in using technology?

Analysis of this example showed that Arabella was open to using Weebly in her teaching, even though she had no previous experience using this tool. The previous blogging tool she had used had not proved reliable and she decided to use Weebly instead. Arabella felt that this tool was easy to use and maintained a positive attitude overall towards integrating a new tool into her teaching. Arabella was comfortable supporting students during tutorials and gave feedback on their websites. This example links to mastery experience. Whilst Arabella did not have extensive experience using Weebly, she explored its features and make a judgement about its suitability, specifically that it was a better fit for her subject than the previous blogging tool. The previous blogging tool used in her teaching was not reliable and Arabella

knew there was a risk of failure if she decided to use this tool. Arabella's experimentation with Weebly, although limited and not within the context of teaching and learning, influenced her decision to use the tool and allowed her to feel comfortable with its use. Arabella also showed resilience and maintained a positive attitude highlighting her ability to move beyond any small failures and focus on the task in its entirety and her intend for using the technology in instruction.

4.6.6.1.2 What value did Arabella place on technology?

An analysis of the above example showed that Arabella valued the use of Weebly in her teaching. She felt that it was important for students to create an online resource that they could share with their peers. She also believed that it was important for students to have a tangible resource that they could use beyond the context of her subject that would be relevant to future teaching practice in a TESOL setting. In analysing this example according to Eccles's Expectancy-Value Theory, it is clear that Arabella's use of this technology was at a cost. Specifically, Arabella had limited experience with Weebly. However, her utility value, showed that she perserved with using the technology because she saw the benefits of the tool for student learning.

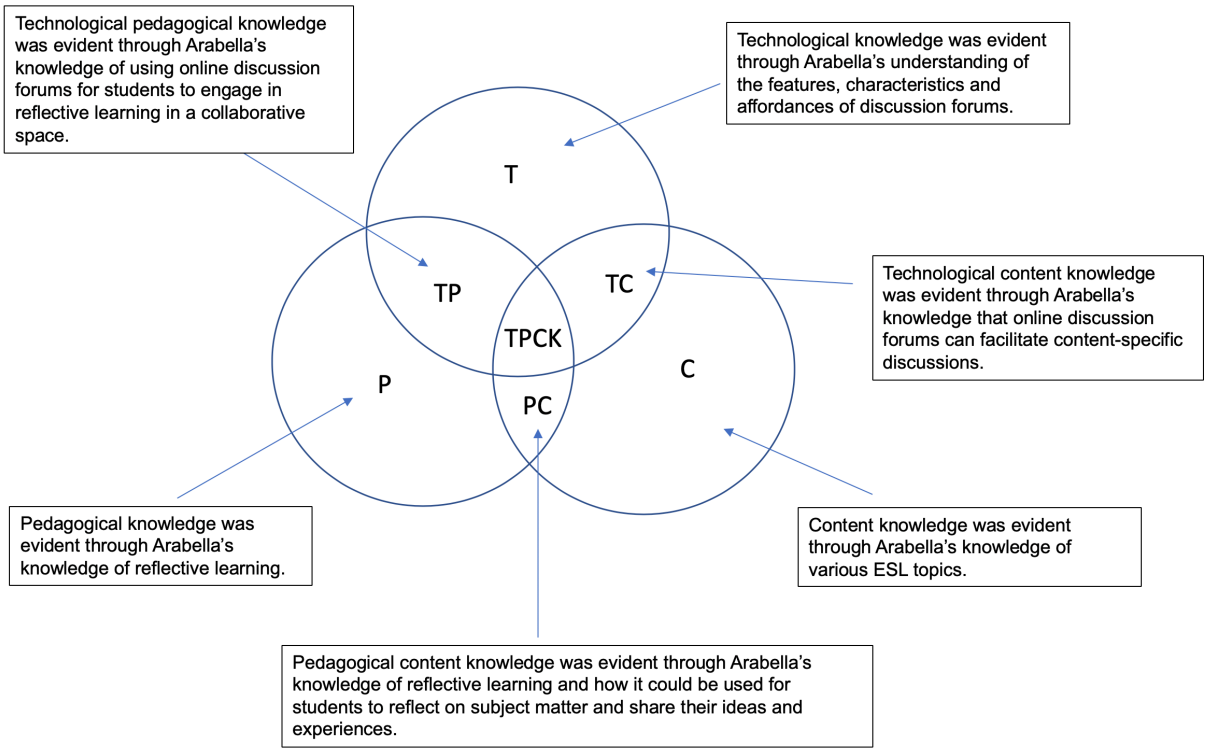
Overall, this example has shown that Arabella was able to draw on her TPCK to successfully use Weebly in Subject 900. She displayed a positive attitude towards Weebly even though this tool was new to her teaching. Arabella highly valued the use of Weebly because technology was an integral component of her subject, and students could use it in their future professional practice. Thus, this example shows a relationship between knowledge, self-efficacy and value. For example, Arabella valued the activity of blogging in her subejct. Given that Arabella valued this activity, she experimented with different blogging tools and decided Weebly was the best fit for her subject due to its ease of use. Through experimentation with the tool, Arabella enhanced her technical knowledge and developed an understanding about how effective the technology would be in teaching. The activity of building technical knowledge, reassured Arabella and lifted her self-efficacy. Although Arabella did not have a strong efficacy for Weebly, she did believe that she would be successful using the technology and was resilient to any technical issues that occurred during teaching.

4.6.6.2 Discussion forums

Another example of Arabella's technological, pedagogical, content knowledge was seen in her use of online discussion forums on Moodle. These forums were designed for students to share their ideas and experiences related to the subject. Arabella did not maintain an online presence on these forums, and instead spoke about how she monitored students' learning, as she did not want to be an authoritative figure in this space. Through analysing this task, it was evident that Arabella was able to bring together her knowledge of technology, pedagogy and content to use discussion forums in her teaching. For example, Arabella showed knowledge of content, specifically knowledge of different ESL topics. She

further showed evidence of pedagogy through reflective learning, as students reflected on subject content and shared their ideas and experiences. Finally, her knowledge of technology was seen in the publishing tool of discussion forums on Moodle. She was familiar with how to set up a forum and post questions to students. Through the combination of knowledge in all three areas, Arabella showed evidence of TPCK in her teaching.

Below is a graphic representation of the knowledge domains found in Arabella's use of online discussion forums in her teaching:



4.6.6.2.1 How self-efficacious was Arabella in using technology?

Arabella had a high level of self-efficacy for developing discussion forums. This example relates to Bandura's concept of mastery experience. Mastery experience was evident as Arabella had previously developed discussion forums on Moodle and experienced success with this process.

4.6.6.2.2 What value did Arabella place on technology?

An analysis of the above example showed that Arabella valued the use of discussion forums in her teaching. She felt that discussion forums gave all students the opportunity to share their ideas and experiences about a specific topic. Given that she knew that not all students participated in face-to-face discussions, she used technology as a way to overcome this issue. Thus, Arabella used discussion

forums to give all students an active voice in learning. Thus, the value Arabella placed on discussion forums in her teaching links to Eccles's construct of utility value. This concept was evident in the example because Arabella saw the usefulness of the technology and how it could promote collaborative learning as well as an avenue for all students to participate in learning.

Overall, this example highlights that Arabella was able to successfully draw on her TPCK to use discussion forums in her teaching. This example suggests that Arabella had a high level of self-efficacy for using discussion forums, as she appeared to use them with ease. She highly valued discussion forums for reasons such as providing all students with an active voice and allowing them to engage in reflective learning. A relationship among the three theoretical constructs was also evident. Arabella valued the use of discussion forums in her teaching and believed they allowed all students to engage in collaborative learning. However, Arabella's previous teaching in the subject showed students did not value the types of learning activities they were completing through the forum. In the previous year, Arabella used discussion forums for students to answer content-related questions, but students felt that posts where repetitive and disengaging. Thus, Arabella's TPCK accomodated this new knowledge and instead, she reflected on how she could better use discussion forums in her teaching. Whilst Arabella's TP knowledge developed, her T knowledge for discussion forums did not change. Thus, she maintained the belief in her ability to successfully use discussion forums technically in her teaching. She also displayed a positive attitude toward her new way to approach discussion forums and this did not influence the belief she had in herself to use discussion forums in teaching.

4.6.6.3 Conclusion

The two examples above provide evidence of how Arabella effectively used Weebly and discussion forums in her teaching. Analysis showed that Arabella used Weebly for students to present and share their evaluations of teaching resources, and to also have a tangible product to use beyond the context of the subject. Discussion forums were incorporated into teaching for all students to reflect on subject content and share their experiences. Arabella's case showed that she had an openness to technology use and maintained a positive attitude towards the use of Weebly in her teaching. She displayed a high level of self-efficacy towards discussion forums because she had previously used them in her teaching. Overall, Arabella valued the use of technology, because it related to students' future professional practice and supported learning.

4.7 Case 6: Anthony – second-year undergraduate web design subject

So how are they going to keep up to date? Part of that learning is for them to actually generate some techniques to support them.

4.7.1 About Anthony

Anthony was a lecturer in the School of Law, Humanities and the Arts. He taught graphic design with a focus on interface design and design thinking. Prior to his employment as a full-time lecturer he had worked at another Australian university, where he has been involved in setting up web-design subjects, working with interface design and using software such as Adobe Creative Suite.

Anthony was involved in three subjects during the 2015 Autumn Semester: a second-year undergraduate elective that focused on app design, a second-year undergraduate web-design subject introducing students to the principles of user-interface in web design and a digital photography subject, which was part of the visual arts program. The web design subject followed a traditional approach, where students attended a one-hour lecture and a three-hour studio. This differed from the visual arts subject, where students would be involved in a four-hour studio. There was flexibility in when lecture content was delivered during the four-hour class. Anthony outlined that at the beginning of these subjects, more time was spent explaining the subjects and outlining student expectations. This usually involved three to four hours of talking time, but as the subject progressed less time was dedicated to explanations and more time to completing projects. Anthony took on more of a consultation role during the second half of these subjects, when students were completing their projects.

4.7.2 About the subject – teaching undergraduate students the principles and applications of web design

Subject 200 was designed to provide students with the opportunity to explore visual design principles and knowledge that underpin graphic user interface design and brand development. Key concepts and methodologies related to design research and practice were addressed, and students were required to apply a selected model during development of graphic user interface design, branding, and information systems, across print and screen-based media.

This subject existed prior to Anthony becoming subject coordinator. However, when appointed subject coordinator, he decided to implement a new structure, which he had implemented at a university where he had previously been employed:

> *The web design was something that was in existence when I got here, but I was primarily employed for that role and I actually had the subject that I developed for [another Australian university], which I basically implemented here.* (Anthony, Beginning-of-Semester Interview, 2015)

Anthony noted that there had been some resistance around his implementing his own structure:

> *There was a little bit of resistance, you know, like, coming in with my own sort of structure. But yeah, once people sort of saw what it was, they understood where I was coming from.* (Anthony, Beginning-of-Semester Interview, 2015)

Subject 200 had a total of 44 student enrolments. The subject was designed to run for one 13-week semester with a one-hour lecture and a three-hour studio. Lectures addressed key ideas related to subject matter, and studios were based on students' completing a project related to industry.

The subject included four assessment tasks: information design and data visualisation (20%, due in Week 4), website analysis (20%, due in Week 9), website rebrand and redesign (35%, interim submission due in Week 10 and final submission due during the exam period) and major design process and reflective report (25%, due during the exam period).

The information design and data visualisation assessment required students to work in groups to graphically represent the data they had been given. They needed to provide an overall visual representation of the data and the relationship between the sets. The students were informed that they needed to consider the principles of data visualisation discussed during lectures and workshops. The website analysis involved students working in groups to select a website and thoroughly analyse its design, structure and functionality to see 'how well it makes use of the web medium'. For the third assessment, website rebrand and redesign, students worked in groups to rebrand and redesign a website. They needed to consider basic functionality and usability issues; however, they had the freedom to be as creative as they wished with their design. The task involved selecting an existing website, analysing the website and, based on their analysis, creating an improved website. The students were then required to develop a presentation of their design proposal. The final assessment, the major design and reflective report, required students to work individually to reflect on the design process and outcomes of their major project. They were required to analyse their project experience, identify new learning and discuss how the experience could affect future practice. The students were required to start an individual

blog from Week 1 and create a weekly 200-word entry that discussed one critical incident and a visual representation of their design. Students then needed to submit a reflective report.
Technology use was imperative to all the assessment tasks within Subject 200.

4.7.3. About technology use

Anthony noted that there was a university expectation that students had access to the subject outline through their subject's Moodle site. He said that making the subject outline available on Moodle was a more effective way to distribute the documentation to students:

> *Well, one is there's that point for everyone to access the subject outline, and, in fact, it's an expectation now that we do that. I mean, you know, that makes perfect sense. So, rather than what we used to do not so long ago, [which] was of course [to] print all these out and physically give them a copy and then, you know, they would lose it, or of course might not have been in class that week and all that sort of thing. This way, they've got a copy, and if you have to make an update to it…so, that part of it works really well, and it makes a lot of sense. And, of course, it means that, you know, I mean people might just have it on their tablet. They don't have to actually print it out, there it is. So that makes a lot of sense. It's a no-brainer, I'd say.* (Anthony, End-of-Semester Interview, 2015).

Anthony believed that students should be using technologies that are appropriate to their discipline area, and that they should have a choice in the type of tool they used, instead of being told which technologies to use. He felt that when students were told what tool to use, this deterred learning and placed more focus on the process being driven:

> *I'll certainly have that philosophy. You know, it's important that they're using something so, that's at the end of the day, that's a key element. I mean, if you try and force something on them that they're just not going to use, then, you know, it sort of loses its meaning. And also, if they're using a blog in one subject and then you expect them to use a different platform in another subject, you know, all of a sudden having to learn these different platforms, it becomes process-driven or compliance-driven rather than actually getting on and doing the activity of learning.* (Anthony, End-of-Semester Interview, 2015)

Anthony felt that it was important for students to have the support they needed to use particular software. However, he believed that it was more important for students to be focused on the principles of design than to become experts in software:

> *So how are they going to keep up to date? Part of that learning is for them to actually generate some techniques to support them. I mean it's not that I'm going to say, 'Oh, don't talk to me about*

> *that. You go and….' I mean, I'll help set up where they might be able to go. Some of our staff have particular expertise in some software, and that might be included in some of their subjects, but, again, generally we're more focused on the principles of design, the thinking that they're bringing to it and [their] understanding it.* (Anthony, End-of-Semester Interview, 2015)

Lecture and workshop observations showed that technology was integrated into Subject 200. Examples included the use of Moodle and blogging software, as well as the Adobe Creative Suite, including Photoshop. These forms of technology were integrated to support student learning, allow for reflection on subject content and create using technology.

Example 1: Moodle supplement for learning

Observation showed that Moodle was used in the subject for students to access the subject outline, lecture notes and references:

> *Essentially, as a place to deposit things that specifically [are stored on] Moodle, yeah, essentially, I put the subject outline, I put the lecture notes there. I don't find the interface terribly intuitive. It's better sending emails through Moodle than through SMP because it'll go straight to their account, but I – even just in this current session we're in – tried to sort of add, you know, to personalise the interface, and again, it's just really rudimentary. So, you know, I personally find it hard to engage the interest, and I wouldn't be surprised if that's reflected in the students. You know, I guess it depends. I mean, we don't do tests, so I could see where some things like that might suit the Moodle site. It's certainly a good place, you know, I can put up references there for the students to go and access, and so that's what I do.* (Anthony, End-of-Semester Interview, 2015)

Example 2: Reflective blog

A subject artefact showed that students used a reflective blog to document their learning in the subject:

> *We use it as a point for them to document their process, which includes their thinking, their research, their schemata, which is their sort of sketches and visual, you know, ideas represented in a visual form, you know, the back-of-envelope sketches, that sort of thing, scanned and put in. Obviously, things like a blog allow video to be inserted, whether it's a reference or whether they've shot a bit of video. It just gives a lot more flexibility than perhaps a written journal, for instance, but many of the students would still use a written journal. But really, I sort of encourage them: 'I don't mind, as long as you're journaling in some form or another.'* (Anthony, End-of-Semester Interview, 2015)

Anthony provided students with choice in selecting the technology they would use to compete their reflection:

> *We do get them using blogs in some form so, you know, some might use Tumblr. Really, you know, as long as it's accessible for me to view and just something that's going to allow them to collate all their visual research – and that's where things like Pinterest work so well. So, you know, and again, some of them use it, some of them don't. Instagram can also sort of work to some extent and, you know, I must admit I think allowing them to choose what works for them is an important part of the equation, rather than forcing something on them.* (Anthony, End-of-Semester Interview, 2015)

For assessment, Anthony said that students would email him the URL of their blog for marking. Anthony explained how he would mark student work against a marking rubric in Word and then either email or hand a hard copy back to students during class:

> *At the moment, I do a combination of either getting them to email me their blog URL, which would have been the case for the subject that you saw...at the moment, I do a hard…well I do it in Word, I've got a rubric that I mark them against, which has got the assessment criteria, and then I'll put some comments in. Then I either give it back to them in hard form or I email it to them.* (Anthony, End-of-Semester Interview, 2015)

Example 3*: *Traditional lecture

Observation showed that Anthony delivered a traditional lecture. He explained how he would include examples from the textbook and examples from personal experience in his lecture:

> *I will sometimes include examples from the textbook and other instances – or a combination of – include some of my own examples that I've come across.* (Anthony, End-of-Semester Interview, 2015)

Example 4: Adobe Software

Face-to-face observation showed that students used Adobe to rebrand and redesign a website. This task was linked to Assessment 3 and students worked in groups to complete the task. Students worked collaboratively with their peers during class time to solve the design-based problem using Adobe software.

4.7.4 Reflections on teaching

Overall, Anthony's reflection of the subject showed that he felt Moodle was a great place to upload resources:

> *Moodle works really well in that I can load it there; the students have got access to it. If they choose to print it out and misplace it they've got a copy there. So, from that sort of point of view of being a repository for material for the class, that works really well. So yeah, that way I can put the lecture slides there, they can print them out beforehand, or if they can't make the lecture, they've got those sort of pointers to refer to.* (Anthony, End-of-Semester Interview, 2015)

Anthony felt that he would incorporate Moodle more into his teaching if its interface was more visually appealing. Given that he was teaching a design class, he wanted the interface to be exciting and of interest to not only his students, but also himself, and felt that better platforms were available to suit his discipline area and what he was aiming to achieve with his students:

> *Personalise it through, you know, an easier use of perhaps images. You know, you've got to remember this is a design class; it might be different for a different discipline, but our students are very visually orientated and so lists of text don't really get them too excited, nor me. I think that would be an improvement. I just sort of went through trying…talking to the Moodle people in the session about trying to load some images and I got the feedback and I implemented it, which actually wasn't too difficult. But even then, it was just like sticking an image in a blog. You know, it was difficult to actually control, I couldn't control the margins, so it's obviously set up for people who don't have that sort of visual training. So I understand that, but the offshoot of that is that people like, you know, our discipline I think can have trouble engaging with it, especially when there's so many other interesting forms, you know, Pinterest for collecting your visual material, blogging on WordPress and that sort of thing – where even just using the WordPress interface, I find it's more detailed and it's a bit easier to use.* (Anthony, End-of-Semester Interview, 2015)

Anthony reflected upon the feedback process he was using. He felt that emailing rubrics to students was too time-consuming and required a large amount of effort. He outlined that he wanted to learn how to develop a rubric in Moodle so that he could provide feedback to students through his subject's Moodle site. He explained that barriers to this were not having the resources or time to learn how to use Turnitin:

> *The emailing is certainly a bit laborious, and that's one thing that I was hoping that maybe I might be able to get set up in something like Moodle, to actually facilitate that process. So, you know, I've got the rubric in Moodle and I can put that information directly there, and so that would be a*

> *good outcome. I just haven't had the resources or the time to actually put that together.* (Anthony, End-of-Semester Interview, 2015)

Anthony said how the pressures of juggling multiple roles as an academic meant that he wasn't able to have the expertise he once did in software:

> *I mean in the early days, I used to have an expertise in the software, but of course the companies keep updating it, you know, which is sort of to be expected. So I was sort of spending a lot of time trying to keep up to date. Now when you're doing it, you know, and you're in a…I mean that's part of your normal day-to-day, so you're keeping up to date, but as you actually start to, you know, in academia – more research, administration, you have less and less time for practice and so, you know, all of a sudden, you're turning around.* (Anthony, End-of-Semester Interview, 2015)

4.7.5 Themes that emerged

Two overall themes surfaced about Anthony's use of technology in his teaching: his use of discipline-specific technologies because of their relevance to students' future professional practice, and his belief that students needed to learn how to use technologies outside of class time, as his focus was on teaching the principles and applications of design.

Anthony believed that his subject needed to include the use of discipline-specific technologies. Given that he was teaching graphic design, it was essential that technology use in his subject mirrored the use of tools that students would use in their future professional practice. Thus, integrating relevant tools allowed students to develop profession-specific knowledge.

Anthony believed that students were responsible for learning how to use technology, and that his role was to teach students the principles of design and how to address design-related problems. Therefore, his studios involved students working together in groups to address such problems using software. Other reasons Anthony did not teach students how to use technologies was because of the ever-changing nature of software and how this had evolved over time, as well as the time pressures placed on university teachers.

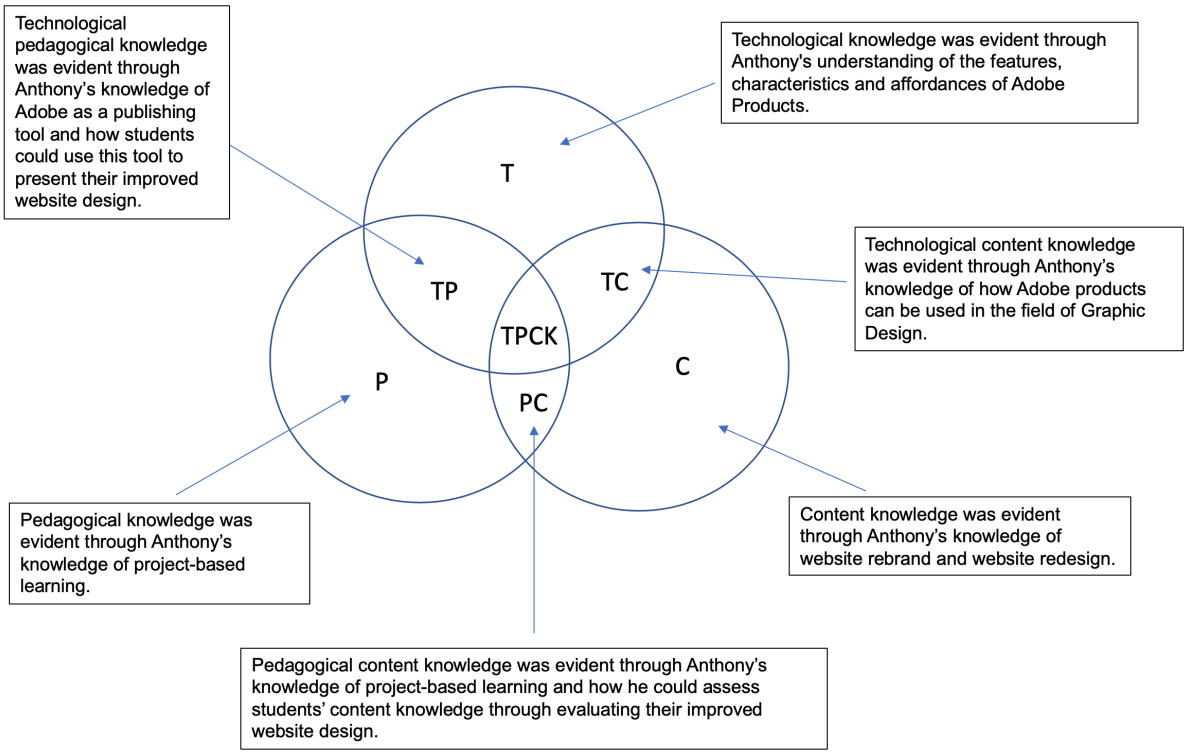
4.7.6 Discussion

The following section describes two examples showing Anthony's successful use of technology in Subject 200. These examples are presented and analysed in terms of knowledge, self-efficacy and technology value.

4.7.6.1 Website rebrand and redesign (Adobe software)

Anthony's technological, pedagogical, content knowledge was seen in the design and implementation of Assessment 3. The major design project focused on students working in groups of three to analyse and redesign a pre-existing website of their choice. The project addressed fundamental principles of the design process, including the concepts of thinking and making, and the Seven-Stage Design Process Model described by Ambrose and Harris (2009). As part of this assignment, students had to improve the design of a poorly developed website. During studios, students used Adobe products to complete the task. Anthony also conferred with each group and provided them with feedback. At the end of the semester, students submitted their proposal. An analysis of this task showed that Anthony was able to bring together his knowledge of technology, pedagogy and content to engage students in analysing and redesigning a pre-existing website according to principles of design. For example, Anthony showed knowledge of content, specifically in website redesign and rebrand. He further showed evidence of pedagogy through using project-based learning, as students were given the problem of redesigning an existing website to improve its design. Finally, Anthony's knowledge of technology was seen in the publishing software, Adobe, as he knew the affordances of the tool and how it could assist students in producing their final product. While Anthony did not have all the technological knowledge associated with the latest Adobe software, he knew where to obtain this technological knowledge if needed. Through knowledge in these three areas and their combination, Anthony showed evidence of TPCK in his teaching.

Below is a graphic representation of the knowledge domains found in Anthony's use of Adobe Software in his teaching:



4.7.6.1.1 How self-efficacious was Anthony in using technology?

Although Anthony did not have a great deal of experience in using the latest version of Adobe, this did not appear to drastically affect his self-efficacy. He believed that there were a number of ways for students to learn how to use Adobe software, such as through experimentation and seeking online support, and therefore his focus was on teaching principles of design. Overall, upon analysis, Anthony maintained a positive attitude towards the use of Adobe in his teaching.

4.7.6.1.2 What value did Anthony place on technology?

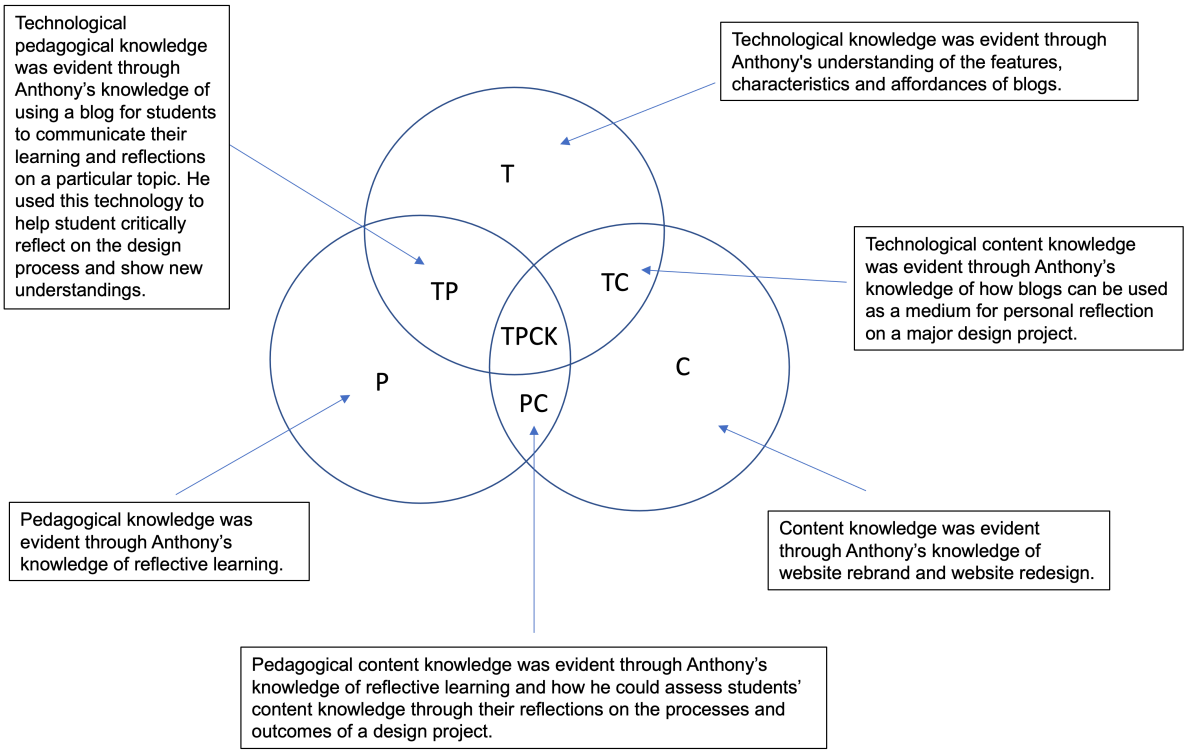
An analysis of the above example showed that Anthony valued the use of Adobe in his teaching because it was a tool that students would need in their future professional practice as a graphic designer. Although Anthony valued the use of this tool in his teaching, he did not believe that he should teach students how to use the tool. Instead, he felt that students were responsible for learning how to use Adobe and he was responsible for teaching students about the design process. Thus, the value Anthony placed on Adobe products in his teaching links to Eccles's construct of utility value. This concept was evident in the example because Anthony saw the usefulness of the technology to students' future career in graphic design. Utility value was also evident as he valued self-pace learning where students could watch videos on how to use Adobe depending on their level of expertise,

Overall, this example has illustrated how Anthony was able to draw on his knowledge of technology, pedagogy and content to successfully use Adobe in his teaching of Subject 200. He displayed a positive attitude towards Adobe and valued the use of this tool in his teaching because it had relevance to students' future workplace. Thus, a relationship is evident among the three constucts in this example. Anthony utilised Adobe software because of its importance to the field of Graphic design. Although he did not have the technical expertise needed to use the latest version of software this did not impact his self-efficacy. Instead, he believed that students should be responsible for learning how to use the technology and thus, student TK for Adobe connect was important in this example. Anthony transferred the responsibility of learning how to use the software onto students and thus, focused more on pedagogy and content. Given this transfer of responsibility and Anthony's beliefs about how his subject shoud be delivered, his limited T knowledge for using the latest version of Adobe software did not hinder his self-efficacy. He still had a high level of self-efficacy for his ability to teach design related processes to students through a discipline specific technology.

4.7.6.2 Reflective blogs

Another example of Anthony's technological, pedagogical content knowledge was seen in the use of blogs in his subject. As part of an assessment, students needed to create an individual blog (WordPress or similar) and reflect on the processes and outcomes of a project. Students needed to create a 200-word weekly blog entry where they identified and described one critical incident and included a visual representation of their design developments. An analysis of this task showed that Anthony was able to bring together his knowledge of technology, pedagogy and content to engage students in reflecting on the the web design process and experiences they encountered. For example, Anthony showed knowledge of content, specifically in website redesign and rebranding. Anthony showed evidence of pedagogy through using reflective learning as students were required to reflect on their weekly progress and document a critical incident and their progress. Finally, Anthony's knowledge of technology was seen in his use of blog-publishing software. Through knowledge in these three areas and their combination, Anthony showed evidence of TPCK in his teaching.

Below is a graphic representation of the knowledge domains found in Anthony's use of reflective blogs in his teaching:



4.7.2.6.1 How self-efficacious was Anthony in using technology?

An analysis of Anthony's case showed that he maintained a positive attitude towards the use of blogs in his teaching. He believed that it was the students' responsibility to select a tool that they felt most comfortable using to complete their reflections.

4.7.2.6.2 What value did Anthony place on technology?

An analysis of the above example showed that Anthony valued the use of blogs in his teaching, as they allowed students to engage in critical reflection. This example shows that for Anthony, reflection was a critical part of design, and blogging was incorporated to assist students in understanding the design process and how they could approach similar design tasks in the future. Thus, the value Anthony placed on the use of blogs in his teaching links to Eccles's construct of utility value. This concept was evident in the example because Anthony believed that blogs allowed students to engage in reflective learning.

Overall, this example has highlighted how Anthony was able to draw on his knowledge of technology, pedagogy and content to successfully use blogs in his teaching of Subject 200. Anthony displayed a positive attitude towards the use of blogs and valued blogging because it promoted self-reflection, which was a key part of the design process. Thus, a relationship is evident among the three constucts in this example. Anthony utilised blogging because it allowed students to reflect on the design process and show

critical engagement with the design process. Although Anthony understood the affordances of blogs, he allowed students to select a blogging tool that they felt most comfortable using. Students therefore draw on their own T knowledge, increasing Anthony's belief that students would be able to complete the task. Allowing students to select a tool they were comfortable with allowed Anthony to make an assessment about whether the task would be successfully, ultimately elevating his own self-efficacy.

4.7.2.3 Conclusion

The two examples above provide evidence of how Anthony effectively used *A*dobe and blogs in his teaching. Analysis showed that Anthony included Adobe products in the design of Assessment 3 to assist students in creating an improved design of a pre-existing website. Blogs were used in Assessment 4 to promote student reflection on the design process. Anthony's case showed that he had an openness to technology use and maintained a positive attitude towards the use of Adobe even though he did not have knowledge of the latest version of Adobe products. Anthony also maintained a positive attitude towards the use of blogs, and he felt that it was each student's responsibility to learn how to use technologies in his subject. Overall, Anthony wanted to integrate technologies into his teaching to prepare students for the tools they would use in their future professional practice.

4.8 Case 7: Stephanie – first-year undergraduate educational technology subject

We're not about teaching tools. We're are about teaching thinking about technology.

4.8.1 About Stephanie

Stephanie was a senior lecturer in the School of Education. Her area of expertise was in educational technology and teacher practice. During her six-year employment at the university, Stephanie had worked as both a lecturer and a senior lecturer. Prior to Stephanie's employment, she had completed a postdoctoral degree and worked as a sessional tutor in teacher education at a Sydney university. Stephanie had had previous careers in graphic design and high-school teaching. She had worked at a number of private high schools in America, specifically in photography; at one of these schools she worked in the IT department mentoring teachers in the use of technology in teaching. Stephanie's passion was in learning how to use technology. Although she did not receive formal technology training, her knowledge of IT grew from experimentation and practice. Stephanie's research focused on teacher choice surrounding technology, specifically the reasons teachers decide to use technology in their teaching or avoid its use.

Stephanie's teaching responsibilities focused on both undergraduate and postgraduate programs, specifically five education-based subjects. She was the subject coordinator of a first-year undergraduate subject (Subject 101) and a postgraduate master's subject; both provided students with an introduction to technology use in teaching. Stephanie was also the coordinator of an Early Years subject, which focused on the integration of technology in early-years education. Although Stephanie had designed this subject, it was taught by other academics and tutors, as Stephanie's area of expertise was not in early-years education. The remaining two subjects in which Stephanie was involved included a postgraduate subject, where she was a guest lecturer, and an undergraduate subject, where she had a four-week teaching block, lecturing and tutoring in the subject.

4.8.2. About the subject – teaching first-year undergraduates the principles and applications of technology integration

Subject 101 was a first-year undergraduate subject offered in the School of Education to Health and Physical Education students. This subject was designed to allow students to explore the use of information and communication technologies in a number of education settings. Students were able to critically examine and reflect on how technologies could support educators in creating engaging learning environments for their students. Throughout the course of the semester, students were introduced to the role of technology in education, theories of learning and strategies of integration, IT initiatives in New

South Wales, research on educational technology and emerging technologies. There was a specific focus on the Horizon Report, which is released annually and provides a comprehensive outline of emerging technologies and how they can influence teaching and learning.

Stephanie had first taught Subject 101 in 2011. Although this subject had been taught by another academic prior to 2011, Stephanie said that she had made minor changes to the design of the subject, specifically to include a new assessment task:

> *The design of that subject is a legacy, so that design has been around for a while. I've tweaked it obviously to add a different… assessment task….* (Stephanie, Beginning-of-Semester Interview, 2015)

Subject 101 had a total of 69 student enrolments. Stephanie said that the subject was designed to run for one 13-week semester with weekly one-hour lectures, presented by either herself, a guest lecturer or a university colleague, and two-hour tutorials. All lectures were held in a face-to-face environment except for two that were delivered online.

The lectures were designed to provide students with knowledge of key concepts specifically related to technology initiatives, theory and research. The tutorials were held in a computer lab and had more of a focus on applying knowledge learnt from lectures. Each tutorial ran for two hours, and Stephanie provided students with weekly tutorial guides. Each guide was structured to include the focus of the tutorial, the learning outcomes that would be addressed, Professional Teaching Standards achieved through participation in tutorial, activities to be completed, take-home messages and activities, self-reflection questions and reminders. In addition to the student guides, Stephanie also developed tutor guides for the teaching staff in her subject; these included housekeeping notes, tutorial goals and step-by-step instructions on the activities students would complete.

Stephanie said that Subject 101 consisted of three parts: Part 1: Learning theories; Part 2: Contemporary ICTs; and Part 3: Research.

The subject began looking at the learning theories of Constructivism, Information Processing and Behaviourism. During this part of the subject, students were introduced to learning about these three theories and how they can be used to frame thinking about technology use in teaching and learning:

> *The basic design of it is we start with…in the first week, lectures…about theory. They're about learning theory and making explicit links between three kinds of core areas, learning theory, with how we think about technology…. This is how some of these technologies relate to some of these*

> *really fundamental ways that we think about learning, or approaches to learning.* (Stephanie, Beginning-of-Semester Interview, 2015)

In addition to being introduced to these learning theories, students also began evaluating ICT resources, such as educational learning objects and websites. Stephanie explained how she wanted students to examine ICT in a more critical way to determine the relevance and appropriateness of resources. Students were provided with a detailed rubric to guide their evaluation of sources:

> *Alongside that, we look…[at] evaluating resources…. [The] rubric we give them is really comprehensive. It's got a lot of things that you think about when you look at technology, just start to get them thinking about technology more critically…. Like what is it, what does it mean for something to be age-appropriate?* (Stephanie, Beginning-of-Semester Interview, 2015)

Following on from Part 1, students began looking at contemporary ICT tools. They were given a video task to complete which involved the use of YouTube and video-editing software:

> *So, those are really easy places to start, so we do that for kind of the first four or five weeks, then we move into a video task.... It's a really explicit task but it gets them using some really sophisticated tools, it gets them using YouTube, it gets them editing video, it gets them thinking about multimodal text and audio and what that means and how those things come together.* (Stephanie, Beginning-of-Semester Interview, 2015)

Part 3 of the subject began to focus more on research and working with various ICT tools. Students were given time to explore a diverse range of tools, for the purpose of social networking, creating websites and spreadsheets and working with data. Alongside this, a review of research was incorporated into Part 3 of the subject to allow students to start thinking critically about new technology initiatives*:*

> *In the final set of tutorials, they're having to look at a lot of those kinds of tools – social networking, creating websites, spreadsheets, working with data.... And then, alongside that, we start having a look at the research more, so, like, we start to help them critically think about 'Okay, here [is] all this stuff, what is it…what do we think it's doing?' And we look at new research initiatives and how do you investigate….* (Stephanie, Beginning-of-Semester Interview, 2015)

Stephanie explained that the subject was structured in this way to address all aspects of the exam, which drew content from Parts 1, 2 and 3 of the subject:

> *That all leads to the exam, which actually covers kind of all…three of them in the exam questions. So, it deals with kind of like learning theory, it deals with kind of contemporary ICTs and it deals with research, usually, depending on the questions I choose.* (Stephanie, Beginning of Semester Interview, 2015)

The subject included four assessment tasks: a digital resource evaluation (20%, due in Week 4), a multimedia project (20%, due in Week 8), a lesson plan (30%, due in Week 13) and an exam (30%, held during the exam period).

The digital-resource evaluation involved students working independently to evaluate two digital learning resources: one learning object, from a digital learning repository, and one educational website using an evaluation rubric available on the subject's Moodle site. Following this evaluation, students had to develop a 1,000-word report detailing their evaluation, including the strengths and weaknesses of each of their chosen resources. Students were also required to attach their completed evaluation rubrics as appendices to their assignment. Following this, the multimedia project, which required students to work in pairs or groups of three, was designed to provide students with a way to practice selecting, manipulating and combining media to communicate an idea. This project was addressed during tutorial time, specifically in tutorials 4 to 8, and there was a focus on introducing students to tools that would assist them in completing their video. Students were instructed to include image, text, audio and film in their video, and to upload a completed product to YouTube in Week 8, prior to the presentation of their video in Week 9. The third assessment involved students working in pairs to develop a lesson plan, based on the Technology Integration Model addressed in tutorials, to illustrate effective integration of technology in teaching. Finally, the exam asked students to respond to several scenarios that addressed software and app evaluation, technology integration and understanding and evaluating research. These scenarios were taken from lecture and tutorial material as well as subject readings. Assessments 1, 2 and 3 were uploaded to Turnitin, which was available to students through their subject Moodle site.

Each task was based on the information students had learnt during lecture and tutorial; specifically, how to critically evaluate and effectively incorporate technology into teaching. Technology was used to support the completion of Assessments 1, 2 and 3. Assessment 1 required the use of technology, as students were exploring online ICT resources and providing a judgement on their suitability to teaching. Assessment 2 required the use of YouTube (and editing software), which allowed students to think about how they could use this tool to create a video-resource communicating an idea. Assessment 1 provided students with a foundation for Assessment 2, as it allowed them to begin thinking about effective resources and therefore apply what they had learnt during this task to the creation of their video. Although Assessment 3 only required students to use Word to document lesson-plan ideas, students were able to search online to view syllabus documents and find resources to use for this assessment.

4.8.3. About technology use

In her beginning-of-semester interview, Stephanie said that technology use in Subject 101 needed to serve a purpose, and that it was essential that students were given the opportunity to think conceptually about technology use and its effective implementation, as opposed to simply learning how to use ICT tools:

> *We're not about teaching tools. We're about teaching thinking about technology and theoretically, the learning theories…. That's really important to us because it's about how you think about the learning that you want to happen…. Like, we do…what's missing in a lot of teacher education is particularly around IT, is that really explicit link to 'What learning outcomes are you looking for?', right. These are the kinds of tools that they give you that….* (Stephanie, Beginning-of-Semester Interview, 2015)

Stephanie described how important it was to instill in students the idea of problem-solving, especially given that technology is constantly evolving. Stephanie outlined that students need to understand how technology works and use this knowledge as a platform for experimenting with ICT tools:

> *And, one of the things we also do is try to instill in them the idea, particularly with the video task, the idea that you will need to problem-solve, you will need to just like get in there and work it out…. The technology will always be changing, and so…the skill is not that you learn a particular tool, the skill is that you understand how technology functions… and just get in there, you know, and have a go. So, you know, we provide some of the space for them to do that thinking and to have that experience.* (Stephanie, Beginning-of-Semester Interview, 2015)

Lecture and workshop observations showed several ways in which technology was integrated into Subject 101. Examples included the use of tools such as YouTube, Excel Spreadsheet, Google Sites and Moodle. These forms of technology were integrated to support student learning, create products and to provide discussion about subject content.

Example 1: Photoshop and Google Sites

Face-to-face observations showed students working with ICT. During these observations, students used either Photoshop or Google Sites to complete a group task set by Stephanie. Each of the observed tutorials followed the same structure: brief introduction, an explanation of the main goals of the tutorial, an exploration of theoretical underpinnings, engagement with the tool through project-based learning and a reflective discussion. Weekly online tutorial guides, available to students on Moodle, were used to provide clear guidance about the focus of tutorials and the activities involved. Planned student-to-student interactions were evident during observations, as students were required to work in pairs or small groups to explore ICT tools.

Example 2: The use of Moodle

Moodle was used as a supplement for learning. Observation showed that Stephanie provided a copy of the subject outline to students on her Moodle Site. She also undertook additional activities on Moodle, such as uploading resources in the form of lecture slides, online lectures, tutorial material, assessment protocols and links to online content, such as websites, which could assist students with learning how to use different ICT tools:

> *For this subject, because it's primarily face-to-face, it's usually mostly for accessing resources: daily resources for tutorials, links for tutorials, readings, subject outline – all your kind of basics, so it's really supplementary. However, this year, we included two lectures with discussion tasks... and we also use it for assessment submission.* (Stephanie, End-of-Semester Interview, 2015)

The two online lectures available through Moodle were presented by guest speakers: a DEC representative and an academic at the university. Students were required to listen to these prerecorded online lectures through Moodle.

Stephanie provided online technology support to her students. This support came in the form of guides: resources and URLs to help students better understand how to use tools that were presented to them throughout the subject. Stephanie said that she used this method in her teaching to support students who had different approaches to learning; for example, she acknowledged that some students preferred to initially address support prior to experimenting with ICT tools. Stephanie also noted that because these resources were continually available, students could refer back to them, especially when they came across an issue or needed to solve a problem when using technology throughout the semester:

> *The tech support I provide for them, and I try to cover most of the tools that we address in the subject.... I do that because while I encourage them to just kind of hunt and peck and find their own support, some students like to go to support first. Like, they just like to go to support or...so when they're like, 'Oh, how do I do this?', I'm like, 'Why don't you look in the tech list first?'* (Stephanie, End-of-Semester Interview, 2015)

Observation showed that Stephanie also used Moodle in a way that differed from its use in previous years. She had set up two discussion forums as a way for students to think critically about educational technology literature, which usually could not be addressed during tutorials because of timing constraints. She also wanted to address the issue of students not completing subject readings, and believed that the inclusion of online discussion tasks presented an avenue to do this:

I set up two discussion tasks, but the real reason for it is that in the tutorials, because we have them doing so much, we often don't get to discuss the literature in a really coherent way and the students don't do the reading. So my thinking is that by having…the discussion task, they'll actually have to do some of the reading, they'll have to at least engage with the reading on some level to be able to answer the task and to be able to respond. So, I'll do my usual, which is post, and respond to other students…in their tutorials…. So, I think that will be a better way to engage with the readings, and it's the tool, obviously; it's a good use of the tool, and I'm toying with the idea. (Stephanie, Beginning-of-Semester Interview, 2015)

Example 3: The use of PowerPoint

Face-to-face observation data showed that Stephanie delivered a traditional lecture, where students were presented with information on key concepts regarding technology initiatives, theory and research. This two-hour lecture followed a one-size-fits all model, and although students could ask questions regarding the content presented, there was minimal interaction and students listened to the ideas discussed by Stephanie. A PowerPoint was used, and observational data suggested that Stephanie was in control of learning and students were passive recipients of knowledge.

Example 4: Adobe Connect

Observation showed that Stephanie used Adobe Connect in Subject 101 to discuss subject related ideas with students. Students did not identify any issues with the use of this tool. She believed that this could have been a result of students' increased exposure to technology in schools over the last several years:

I didn't have any problem. I didn't hear any problems…. I provided them with the support links and all of that, 'If you haven't used it before...'. Here's some help if you need it or not', but…they were fine, though. I am finding these first-year groups over the last couple of years, every year is in fact more...at the very least, has a better ability to problem-solve. And I do truly think that's coming from the schools having more technology. (Stephanie, End-of-Semester Interview, 2015)

4.8.4 Reflections on teaching

Stephanie said that she was happy with how the subject went. She indicated that initially students were not as engaged with the subject matter as she would have liked, but towards the end of the subject, students were interested, there was an improvement in their assessments and they were asking about future IT electives:

I wasn't so sure at the beginning…but overall I was happy with it. And I base that mostly on the fact that the students seemed to come out on the other side with a much better understanding of educational technology…. They were a bit disengaged in the beginning, but by the end they were pretty tuned in. We saw improvements in their assessments and my students were asking me

> *about IT electives, which I find [is] always a good sign.* (Stephanie, End-of-Semester Interview, 2015)

Stephanie said that the students did not like the online lectures in the subject, but she was happy with how they had gone. Stephanie's reflection also showed that there were aspects of the subject she wanted to change; however, given that the subject was not being run again the following year, these changes would not be made:

> *We did a couple of lectures online, which the students didn't like, but we kind of had a whack at it and I think we're pretty happy with it. And…there are a couple of things I'd change but I actually didn't...I on purpose didn't change because we're not running the subject together next year. So there are a few lectures I might have changed, there are a couple of tutorials, but because we're not running it again, I did a bit of work on it but I didn't do the major work.... But yeah, I think it was pretty good.* (Stephanie, End-of-Semester Interview, 2015)

Stephanie said that this was the first time that she had integrated online discussion tasks into her teaching with a completely face-to-face group. Stephanie found that the use of online discussion forums led to a number of affordances, such as supporting students in obtaining a deeper understanding of assessment requirements and reflect on their learning, and providing an avenue for teachers to identify and rectify gaps in students' understandings of subject material:

> *It ended up being really useful, and a lot of the students went and looked at it again. Even that simple act of them having to identify it, they had to identify the learning theory that went with it and do a really simple explanation. It ended up being a lot richer…than I'd originally thought. But I found it really useful to be able to target like what I know to be problems already…all of us kind of picked out an example from our tutorials discussion groups and went over it in tutorial to say, 'Oh, so here's a resource and here's the theory, how we might understand what's happening in that.'* (Stephanie, End-of-Semester Interview, 2015)

An online discussion task was implemented after students had completed Assessment 1. Stephanie felt that this discussion task helped identify misconceptions and issues with this assessment, as students were required to talk about theory and the resource they had selected. Stephanie found that this task let her identify gaps or issues in student understanding and address them prior to the exam, in which Question 1 centred on learning theories and their application:

> *The discussion task that they did for that lecture was actually getting them to use the theory to talk about the resource they identified, which helped us to then think about what they were missing on assessment one, right, so we were able to see where some of the really serious*

> *misconceptions are – which also prepared us for what we see as problematic on the exam a lot, which is that first question on the exam. We actually used that to kind of triage some of the big misunderstandings.* (Stephanie, End-of-Semester Interview, 2015)

Overall, Stephanie's reflection highlighted that Moodle was mainly used as a support in her teaching. The approach of providing technical support to her students on Moodle was also consistent across all her subjects. Even though this support was made available to her students, Stephanie highlighted that her students were becoming more competent at findings solutions to ICT problems, and thus used the support she provided less and less:

> *I always have that in my subjects because I think the tech support in this subject, having that practical component, is really important for them…like, they just don't know where to start. And so that tech support – which has kind of grown over the last couple of years – is for those people. I'm finding students go to it less and less and less because they're more adept at finding support. That said, like whenever I include something new like a tutorial worksheet or stuff like that, we always put it in that list, and it's where they go to kind of download software keys and stuff like that and copyright issues and all the kind of nuts and bolts of working with the tech.* (Stephanie, End-of-Semester Interview, 2015)

Stephanie said that because Subject 101 was a technology subject, it was important to have support available to students to guide them in using technologies. This was important, especially given the timing contrasts in tutorials and her beliefs against teaching students simply how to use technology tools. She highlighted that it was important for students to know how to actively solve problems they came across when using technology:

> *But it's an important component, and this being, like, a technology subject, in terms of learning how to use technology, you have to have that. It's just really important to provide them with some resources to get them started in being able to help themselves, because we can't cover all of it and it's not appropriate for us to. You know, they need to learn to actively solve some of their own problems, and that provides them with a bit of a starting point for it.* (Stephanie, End-of-Semester Interview, 2015)

Although Stephanie said that she used Moodle to provide technology support to students, there were variations in the ways she used this across all her subjects:

> *No, my lowest level of Moodle support is in this subject, but mostly, again, because it's primarily face-to-face.... A lot of our teaching is in the tutorials and in the lectures. Other subjects – my other main subject – for this session…my master's, which is completely online, so my Moodle site*

for…that's really comprehensive, as is my early-years [Introduction to Educational Technology] subject…which is even more complex because.... they're learning primarily online…. It's really comprehensive because it's really super-structured, whereas my master's subject is much less structured. The lectures are more robust; it's more text-based, which they really like, but I also have online lectures from Adobe Connect…. I record our online meetings, so we have a lot of stuff going on in my Master's subject. For my early-years subject, we've got all that stuff going on plus the readings, plus critical questions plus, like, activities, so it's, like, the activities we'd normally do in tutorial, they do online. (Stephanie, End-of-Semester Interview, 2015)

4.8.5 Themes that emerged

Two overall themes surfaced about Stephanie's use of technology in her teaching: her belief that technology must have a clear purpose and must be carefully integrated into her teaching; and her willingness to be open to the use of new technologies in her teaching.

Stephanie believed that technology in teaching must have a clear purpose. She highlighted the need to carefully consider how technology will be used to support students' future professional practice. Stephanie did not believe in teaching students how to use ICT tools; instead, she believed students needed to be critical in their use of technology through being aware of theory and research related to ICT use.

Stephanie's teaching of Subject 101 showed that she was willing to try new ways of integrating technology into her teaching through the incorporation of online lectures and online discussion forums. She felt that online discussion tasks were a way of addressing timing constraints in tutorials and allowed for the identification of gaps in student understanding of subject content. Stephanie also integrated a range of ICTs such as Google sites, Excel spreadsheets and YouTube into her teaching to model successful technology integration to students. She felt highly efficacious in the use of these tools in her teaching.

4.8.6 Discussion

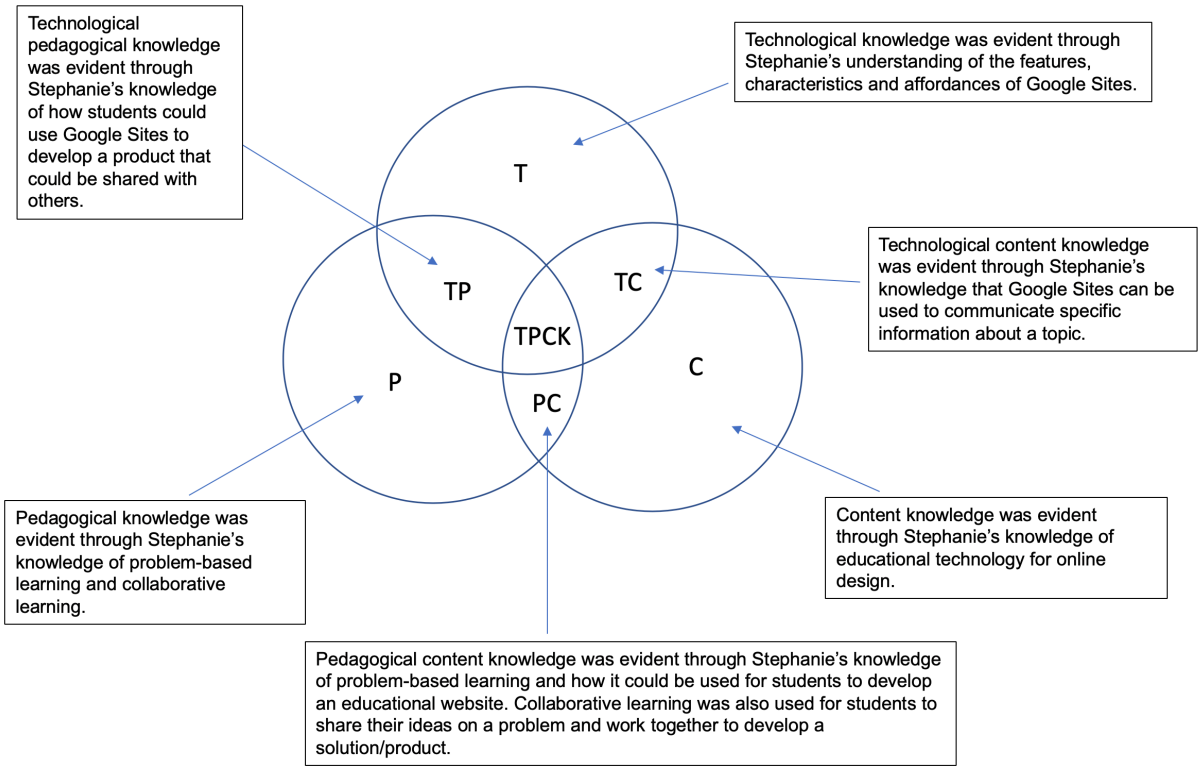
The following section gives two examples of Stephanie's successful integration of technology in Subject 101. These examples are presented and analysed in terms of knowledge, self-efficacy and technology value.

4.8.6.1 Website creation – Google sites

Stephanie's technological, pedagogical, content knowledge was seen in her design of a lesson that involved students working in pairs to create a website on a topic of their choice – students used Google sites to create their website. The purpose of the lesson was to introduce students to how they might use a

website in their future teaching of a particular topic area. Given that the students completing Subject 101 were all enrolled in a Bachelor of Physical Health and Education, they were invited to create a website tailored towards learners they would be teaching; for example, a website on healthy food choices. An analysis of this task showed that Stephanie could bring together her knowledge of technology, pedagogy and content to engage students in a lesson that successfully allowed them to develop an understanding of how websites can be used in an educational setting to support student learning. For example, in the design of the task Stephanie showed content knowledge, specifically in the area of educational design for an online learning environment. Stephanie also drew on her knowledge of pedagogy, through the student-centred approach of project-based learning. In this example, students were given the problem of designing a website that they could effectively use in their teaching of a specific topic area. During tutorials, students worked in pairs to complete the task and engaged in collaborative learning. Whilst students were working, Stephanie provided them with feedback on the website they were creating. Technological knowledge was seen in Stephanie's knowledge of the type of ICT tool that students needed to complete the task (the publishing tool Google sites to develop a website). Therefore, when knowledge in all of the three areas of TPCK were combined, an integrated knowledge base was evident.

Below is a graphic representation of the knowledge domains found in Stephanie's use of Google Sites in her teaching:



4.8.6.1.1 How self-efficacious was Stephanie in using technology?

Analysis showed that Stephanie was highly self-efficacious when using Google sites in her teaching. She enjoyed using technology in her teaching and maintained a positive attitude towards its use. Stephanie believed that she could successfully use Google sites in her teaching and knew where to seek assistance when she encountered a problem, such as seeking support from an online discussion forum. Mastery experience is evident in this example as Stephanie's prior experience and experimentation with the technology boosted her self-esteem and made her feel highly self-efficacious.

4.8.6.1.2 What value did Stephanie place on technology?

An analysis of Stephanie's case showed that she valued the use of website creation in her teaching because students could replicate this skill in their future professional practice. Stephanie believed that technology needed to serve a clear purpose, and this was evident through the design of the task. Further, Stephanie did not believe in showing students how to use ICT tools; this was evident in the above example, as she allowed students to work in class to create their website and provided feedback related to educational design. Thus, the value that Stephanie placed on Google Sites in her teaching links to Eccles's construct of utility value. This concept was evident because Stephanie saw the usefulness of the technology to the work students' may possibly do in their future workplace. Stephanie believed that through student completing the task of creating a website they would gain experience and skills in

replicating the task in their future workplace. Another construct from Eccles's Expectancy-Value theory is attainment value. Stephanie wanted her students to develop their own TPCK and modelled critical engagement and pedagogies when integrating technology into teaching. She wanted to develop within her students …

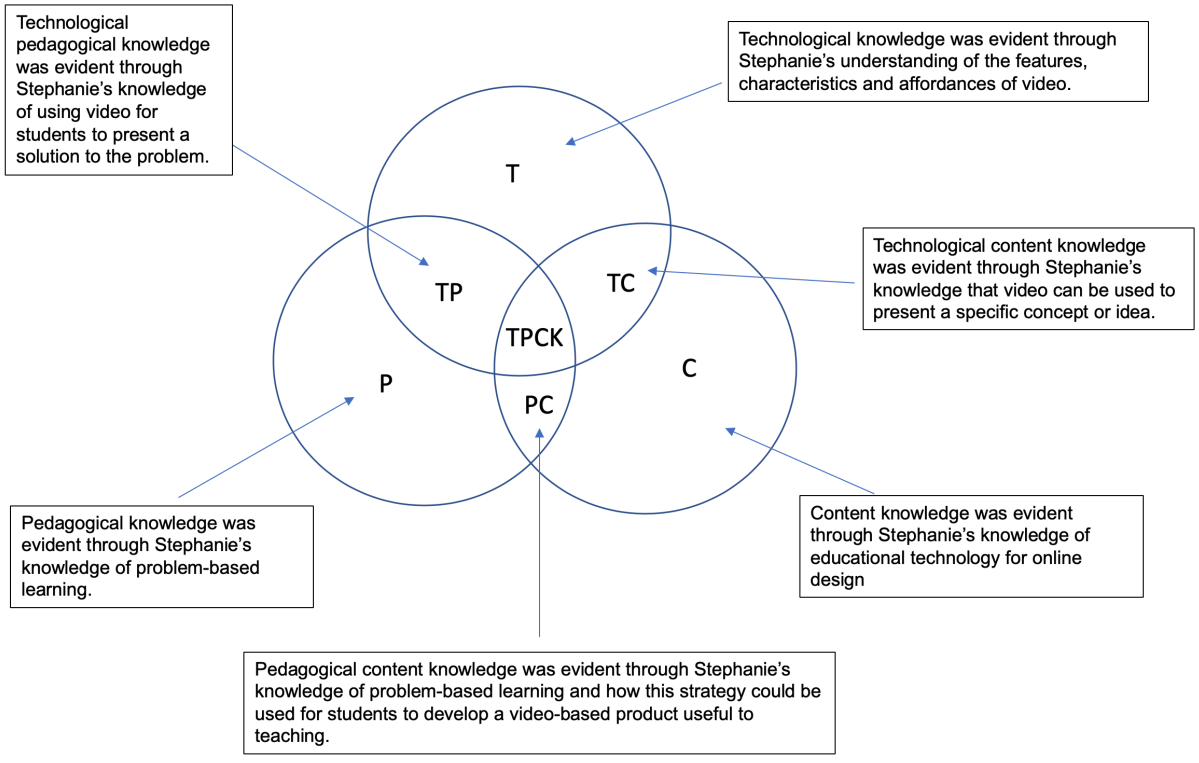
Overall, this example has shown that Stephanie was able to draw on her knowledge of TPCK to successfully use website creation (i.e. Google sites) in her teaching of Subject 101. She exhibited a high level of self-efficacy and valued the use of website creation, as it was relevant to students' future workplace. A relationship among the three theoretical constructs was evident in this example of Google sites. Stephanie valued students critically evaluating the use of an educational technology useful to their future professional practice. She displayed a high level of TPCK for the task and this led to her having a high level of self-efficacy. However, Stephanie wished to develop her own students' TPCK and allow them to feel self-efficacious about the use of websites in their future teaching. She gave students the opportunity to experience with the tool and develop their T knowledge which could have contributed to their developing self-efficacy.

4.8.6.2 The use of video

Another example of Stephanie's technological, pedagogical content knowledge was seen in her design of Assessment 2, a multimedia project that included the use of video and YouTube. The assessment involved students working in pairs or groups of three to create a short video that communicated a skill, idea or concept of their choosing through the use of pictures, video, text and audio. The project extended over Weeks 4 to 8 of the semester. During this time, the students were introduced in class to different software to assist them in working with media. In Week 8, the students uploaded their videos to YouTube, and in Week 9 they presented their final product to the class during the tutorial. Students' videos needed to show consideration of educational learning theory, and their presentations needed to include not only a viewing of their final product, but also an explanation of how they selected and combined media. To further support students' creation of their video, links related to software use were placed on the subject's Moodle site, as well as a high-quality example of a video and an assessment rubric, which provided students with information on how their video would be assessed. An analysis of this task shows that Stephanie could draw on her knowledge of technology, pedagogy and content to develop an assessment task that allowed students to show their understanding of how to combine multimedia to communicate a skill, idea or concept based on theory. For example, in the design of the task Stephanie showed content knowledge, specifically in the area of educational design for online learning, as she clearly communicated to students how to successfully create a video based on educational learning theory. Further, Stephanie drew on her knowledge of pedagogy, through the use of problem-based learning and collaborative learning. Problem-based learning was seen in this example, as students were given the task of creating a

short video. They had to therefore develop a solution to the problem they were given, so that they could present an overall product to their class. Collaborative learning was also evident, as students had to work in small groups to complete the task. Both of these approaches were student-centred and whilst students were completing the activity, Stephanie become a guide/facilitator and provided feedback to students based upon the video they were creating. Finally, Stephanie's knowledge of technology was seen in this example as she invited students to use the presentation tool of video to create a product and also the publishing tool of YouTube to share their product. Stephanie's knowledge of how to use video was seen in a high-quality sample that she uploaded to Moodle for students to understand the expectations for the task. Through knowledge in these three areas and their combination, Stephanie showed evidence of TPCK in her teaching.

Below is a graphic representation of the knowledge domains found in Stephanie's use of video in her teaching:



4.8.6.2.1 How self-efficacious was Stephanie in using technology?

Stephanie's case illustrated that she had a high level of self-efficacy in using video. She was comfortable creating a high-quality video sample to upload to the subject Moodle site for students to view. Stephanie's high level of self-efficacy assisted her in the completion of this task, because she was positive that she

could complete the task successfully. Like Google Sites, this example also links to the concept of mastery experience. Stephanie's case highlights extensive experimentation with technology and resilience to setbacks. In the case of video, Stephanie had experience developing video-based products and understood their affordances in teaching and learning, thus, contributing to her strong self-efficacy.

4.8.6.2.2 What value did Stephanie place on technology?

An analysis of Stephanie's case showed that she valued the use of video creation in her teaching of Subject 101 because students would gain experience in a task that they could use in their future teaching career. Through the inclusion of this task in Subject 101, Stephanie aimed to stress to students the importance of knowing how to successfully integrate technology in their teaching, solve problems that arise when using technology and think conceptually and critically when using ICTs. When completing this task, Stephanie gave students a choice in deciding what skill, idea or concept their video would target, as well as leniency in the software they would use to manipulate multimedia, as she believed that there are a number of tools that are available with the same functionality, and if students learn to think critically about the appropriateness of the tool, this skill will be more useful for their future practice.Thus, the value Stephanie placed on video in teaching links to Eccles's contruct of utility value. Similar to the example of Google sites above, Stephanie valued the use of video creation in her teaching because it was a task that students may replica in their future workplace.

Overall, this example illustrated that Stephanie was able to successfully draw on her knowledge of TPCK to use video and YouTube in her teaching of Subject 101. She exhibited a high level of self-efficacy in using these forms of technologies in her teaching and showed that she valued the task in preparing students for similar experiences in their future professional practice. Thus, a relationship among the three theoretical constructs can be seen. For example, Stephanie valued introducing students to a tool that they would use in their future practice. Given Stephanie's extensive experience with video and its use in teaching, she had a high TPCK and strong self-efficacy. Factors that influenced her TPCK and self-efficacy where her research in the area of educational technology, her background teaching in the area of educational technology and her intrinsic motivation for understanding how technology worked.

4.8.6.3 Conclusion

The two examples above provide evidence of how Stephanie effectively used Google sites and video in her teaching. Analysis showed that Stephanie included websites and video in the design of her subject because these tools had relevance to students' future professional practice. Stephanie also displayed a high level of self-efficacy towards these tools.

4.9 Context and technology use

Data from all seven cases revealed that context plays an important role in activating one's knowledge, self-efficacy and value in a particular instance where technology is used. The below excerpts from the data provides evidence of the contextual factors enabling or restraining university teachers' technology use:

In Gina's case, she reported that the overall design and delivery of each subject in the Early Years degree was guided by Carmen, the director of the Early Years program:

> *I took the lead from [Carmen]. Essentially each week I put things into a workbook. We integrated lecture content in between activities and connected readings. Then there'd be an online forum that [students] might respond to [based on the] lecture or reading so that students are being guided in their critical thinking about the content.* (Gina, Beginning-of-Semester Interview, 2015)

This excerpt highlights how leadership and course goals/objectives can influence one's decision to use technology in their teaching. Thus, this outlines that contextual factors at a course level can impact technology use in the teaching of a single subject. Further, this excerpt also shows that various technologies were considered for learning, therefore, Gina needed to be able to activate her knowledge and self-efficacy for the use of each technology in her teaching showing that a number of contextual factors, such as prior experience and experimentation influenced technology use.

In Tatyana's case, she reported that workload and time were factors impacting her ability to learn new and unfamiliar technologies:

> *Time was the issue... I'd rather do it myself, but I think that my skills are far from… automatised.*

This exercpt highlights how workload and time can impact a university teacher's technology integration in teaching and further, lead one to decide whether they will use or avoid specific educational technologies in teaching. Thus, whilst an individual may be open to the use of technologies in teaching, their technology use may be limited due to their prior experiences and ability to experiment with technology. Thus, workload links to the impact of an institutional factor whilst

In Ji's case, he reported that the nature of each subject has an influence on how he used technology in his teaching:

> *I would say maybe disappointing...that I use basic technologies nowadays...probably mentioned earlier before you started this. I said in my other subjects I use...technology-rich methodologies,*

> *like I develop some fresh video games to explain the concepts to the students.* (Ji, End-of-Semester Interview, 2015)

Thus, the above excerpt, highlights how subject and/or content area, can impact one's decision to use technologies in teaching. Some situations may activate particular knowledge and value for technology use and consequently see university teacher's either use or limit their technology use. This example from the data shows that one's subject and/or content area may be a contextual factor enabling or constraining the extend to which one may activate their TPCK

In Richard's case, he reported that funding for discipline-specific technologies was an issue at his university:

> *One of the biggest difficulties we've got in this university is not access to technology; we all have access to technology, but we don't have sufficient access to money to spend on technology. So, we might have all these great creative ideas, but the money is not there…. I've seen fantastic virtual workplaces where people are walking around…on the screen they can move a person…that's megabucks.* (Richard, Beginning-of-Semester Interview, 2015)

Thus, this excerpt highlights Richard awareness of discipline-specific technologies at his institution and how this contextual factor influenced technology integration.

In Arabella's case, she reported that her institution mandated the use of technology in teaching by requiring staff to have a Moodle site for their subject:

> *You must have a Moodle site for your subject and your subject outline must be on it. Those would be probably the two mandates but with that, they would expect you to do something with it.* (Arabella, Beginning-of-Semester Interview, 2015).

Thus, this excerpt highlights how institutional factors can impact technology integration, specifcally through mandating the use of technology in the teaching of a subject.

In Anthony's case, he reported that he did not believe Moodle's interface was intuitive:

> *Essentially, as a place to deposit things that specifically [are stored on] Moodle, yeah, essentially, I put the subject outline, I put the lecture notes there. I don't find the interface terribly intuitive.*

Thus, this excerpt highlights how Anthony beliefs, influenced by his discipline knowledge in Graphic Design, impacted his overall attitude towards Moodle and its interface in teaching and learning.

In Stephanie's case, she reported that technology use in her subject was not about teaching students how to use technology instead it was about thinking how technology should be used in their teacing:

> *We're not about teaching tools. We're are about teaching thinking about technology.*

Thus, this excerpt shows that Stephanie's beliefs and attitudes influenced her technology use in Subject 100. The nature of her subject area further, influenced her attitudes towards technology use.

In sum, as shown in the examples above, the data has revealed that context has played a substantial role in activating knowledge, self-efficacy and value when using technology in teaching and further, is situation depended. Contextual factors were evident at an institutional level, course level, subject level and activity level. The university teacher's knowledge of how these contextual factors influenced technology use showed evidence of contextual knowledge. Through the university teachers' awareness of institutional requirements for technology use, the availability of institutional and non-institutional technologies within their university and further, how their subjet and each specific activity was influenced by contextual factors, this research has highlighted the situational constraints that impact technology integration.

4.10 Chapter summary

This chapter presented seven cases. Each case provided an in-depth description of the participant, their teaching background, their beliefs about technology and their technology use in a single subject. Examples of technology use from each case were analysed and presented according to the theoretical constructs of this study: Mishra and Koehler's TPCK Framework, Bandura's Theory of Self-Efficacy and Eccles et al.'s Expectancy-Value Theory. The next chapter will present a cross-case analysis, highlighting similarities and differences between cases.

Chapter 5: Cross-Case Analysis

5.1 Introduction

This chapter presents a cross-case analysis of all seven cases. The chapter begins by providing an overview of each participant, the subject they taught (program, delivery and context) and the technologies they used in their teaching. Following this, the themes that emerged from each case, as reported in Chapter 4, are presented in a case-comparison matrix. These themes are discussed in combination and compared and contrasted amongst the other cases.

Table 5.1 provides an overview of each of the seven cases.

Table 5.1 – Overview of cases

	Program	**Delivery**	**Subject context**	**Student dynamics**	**Technologies used**
Gina	Undergraduate	Blended learning	Principles and applications of childcare and education	First-year domestic and international students	Moodle – e.g. mini-lectures, online workbooks, discussion forums and activities, Turnitin PowerPoint Echo360
Tatyana	Postgraduate	Face-to-face Online	Learning theories and their application in education	Master's	Moodle – e.g. lecture notes, discussion forums, Turnitin PowerPoint
Ji	Postgraduate	Face-to-face Online	System-development methodologies	Master's	Moodle – e.g. subject materials PowerPoint
Richard	Undergraduate	Face-to-face Online	Principles and applications of psychological assessment	Fourth year	Moodle e.g. lecture slides, assessment protocols, discussion forum, Turnitin, videos and Adobe Connect PowerPoint Prerecorded videos – video case study

Arabella	Postgraduate	Face-to-face Online	Introduction and evaluation of technologies for second language teaching	International masters' students	PowerPoint YouTube, Web search, Slow-motion Moodle – discussion forums, Turnitin Weebly Survey Monkey
Anthony	Undergraduate	Face-to-face Online	Visual design principles	Second year	Moodle e.g. lecture slides, assessment protocols Reflective blog Adobe software PowerPoint
Stephanie	Undergraduate	Face-to-face Online	ICT use in education	First year	Moodle e.g. lecture slides, assessment protocols, online lectures, tutorial material, links to online content YouTube Excel Google Sites Photoshop

5.2 Case-comparison matrix

Table 5.2 presents a summary of the key evidence from each case relating to each of the theories that framed this research. It is followed by a more detailed explanation of each, organised by theory.

Table 5.2 – Case-comparison matrix

	TPCK	**Self-efficacy**	**Value**
Gina	• Moodle site – TPCK modelled to Early Years Team by Director of Early Years - Carmen • Gina created her subject Moodle site by implementing Carmen's overall design for Moodle (subject TPCK) and creating individual activities on Moodle (activity TPCK). • Good access to technical support to develop technological knowledge i.e. Camellia.	• Gina's self-efficacy was dynamic. • With repeated exposure and repetition of the same online activities each week, such as online workbooks, discussion forums and online lecture recordings, Gina's belief in her ability to complete these tasks grew over the course of the semester. • Support received from Camellia also supported Gina's developing TPCK.	• Valued PowerPoint to convey content knowledge to students. • Believed online discussion forums give international students an active voice. • Believed online discussion forums allow demonstrated evidence of outcomes.
Tatyana	• Limited technological knowledge (TK) for developing online content (i.e. discussion forums) on Moodle. However, knew how to source 'T'. • Evidence of drawing on her colleague's knowledge – Carol.	• Tatyana knew how she wanted to include online discussion forums in the design of her subject. However, she was aware that she did not have 'TK', and this significantly affected her level of self-efficacy in using this technology. • Tatyana was highly self-efficacious in using PPT in her teaching, as this was a tool she had used in her previous practice.	• Expressed wanting to learn how to create online discussion forums on Moodle. Tatyana believed time was a factor influencing her ability to complete this task. • Valued PowerPoint to convey content knowledge to students.
Ji	• Believed that the nature of Subject 800 restricted the use of complex technologies in his teaching. Instead, simple technologies were integrated into his subject. This showed evidenced that Ji's TPCK was operating at a low level in Subject 800. • Believed in different TPCKs for different subjects. Some subjects include more-complex technologies than others.	• Reported that he was highly self-efficacious in using a range of technologies. However, his subject included low level technology use. • In Subject 800, Ji used technologies that he had previously used in his teaching. He believed that he would be successful in their use e.g. PowerPoint.	• Valued PowerPoint to convey content knowledge to students. • Technology served as a distraction – the content was too complex, and Ji believed technology could not enhance learning in Subject 800.
Richard	• Limited technological knowledge (TK) but knew how to source 'T'. • Drew on Todd's knowledge to develop video-based teaching materials.	• Preparation led to Richard's self-efficacy being constant i.e. in the case of video-based teaching materials. • Richard was willing to give technology use a 'go' and did not allow his lack of 'T' to affect his intended objectives for the subject.	• Valued the use of technology as a resource; he used video-based materials to provide students with a real-life, authentic example of a clinician-client interview. • Valued the use of technologies that assisted students in understanding their future workplace. • Valued the use of technologies to communicate with students and mirror collegial discussions in a workplace environment – Adobe Connect.
Arabella	• Good TPCK; for example, used Weebly and discussion forums successfully in her teaching.	• Self-efficacous using PowerPoint and online discussion forums, as she had used these tools in her previous teaching.	• Technology use was important to her subject, which focused on using technology in second-language teaching.

	• Focused on developing TP(professional)CK in students.	• Displayed a positive attitude towards Weebly, even though she had limited experience in using this tool.	• Did not believe in teaching students how to use technologies. • Focused on preparing students for future professional practice. • Valued the use of online discussion forums: all students could share their ideas. • Wanted students to create tangible technology products for use beyond the subject.
Anthony	• Good TPCK. • Focused on developing TP(professional)CK in students.	• Maintained a positive attitude towards technology use in his subject. • He did not have knowledge of the latest versions of Adobe. However, he knew where to source this knowledge and thus, this did not appear to negatively affect his self-efficacy.	• He believed students were responsible for learning how to use technologies and he was responsible for teaching principles of design. • Focused on preparing students for future professional practice.
Stephanie	• TPCK was highly aligned. • TPCK evident in multiple examples such as Google sites. • Focused on developing TP(professional)CK in students.	• Highly self-efficacious in using technologies in her teaching. • Experimented with technologies and was open to the use of new technologies in her teaching.	• Believed that students are responsible for learning how to use technologies. • Focused on preparing students for future professional practice. • Wanted students to think critically about the use of technologies in teaching.

5.2.1 Cross-case analysis

5.4.1.1 Technological, pedagogical, content knowledge

Theme 1: Learning Content Focus vs. Professional Practice Focus

A comparison of the first three cases showed that Gina, Tatyana and Ji integrated technologies into their teaching with a focus on content. All three participants used technology to help students gain an understanding of subject matter and show evidence of learning outcomes. PowerPoint was used by Gina, Tatyana and Ji to support the transmission of knowledge from instructor to students and further, to visually present students with key points on a topic. Gina and Tatyana used online discussion forums for students to discuss and reflect upon key ideas presented in the subject. Ji used his Moodle site as a place for students to access subject documentation such as case studies that they could read prior to face-to-face classes. The technological pedagogical content knowledge demonstrated by these three participants was based on the delivery of content. Thus, there was a strong alignment around content delivery; this provides a distinction between these three and the remaining four cases of this research.

Comparing the above cases to the cases of Richard, Arabella, Anthony and Stephanie shows a shift from learning content to using technology for future practice. The cases of these four participants presented similar findings, as they all believed that the use of technologies in their teaching should prepare students for their future professional practice. Richard's focus moved beyond the context of Subject 400 and addressed the competencies and skills that students will need in their future workplace. Technology in Subject 400 was used to help bring students' future workplace to life and gave students the opportunity to

see how their future workplace operates, particularly through the use of video materials. Students analysed the video case of Dominique and observed the clinician and the client in the video as they operated in the natural setting of a clinician's office during interview. Through observation and discussion of these resources, students were working towards an understanding of their future workplace. Thus, Richard's thinking focused on what the students would do with the case study. There was a focus on information provision but also on discussion to deepen student understanding. Thus, Richard's teaching model was sophisticated and his value of helping students to develop an understanding of their future workplace drove his use of technology and the experiences that students engaged in during the course of Subject 400. Richard showed a good understanding of the content of his subject area and pedagogical practice; however, he was limited by his technological knowledge. He knew what he would like to achieve with technology, but his limited TK influenced his ability to independently execute his design model using technology. However, he was able to source TK from technical support (Todd); thus, he understood where to get this information. Through drawing on his colleague's TPCK, Richard showed that he could fill gaps in his knowledge and integrate technology successfully.

Arabella and Anthony varied slightly to Richard's case, as they focused on preparing students for work in their professional context through developing their students' digital literacy. Arabella's and Anthony's cases addressed the development of students' professional capacity, and the technology integration in their subjects was intended to support this development. For example, Arabella's students would use the same educational technologies in their future teaching of ESL students, and Anthony's students would use Adobe in their future workplace to complete graphic-design projects for clients.

Stephanie also showed that she focused on developing students' professional practice; however, her knowledge was extended through her research on using technology in teaching. Stephanie stayed up to date with this knowledge and showed a high level of technological knowledge, which differed from Arabella and Anthony's cases. Although Arabella and Anthony explained that they did not have a deep understanding of the software or educational tools being used, they knew how to source this knowledge if required. Thus, Stephanie's TPCK was constantly being challenged because this directly affected her research focus and belief that this was important for her teaching. This research study, therefore, finds that context not only relates to the person but also the subject. For Stephanie there needed to be a strong alignment between the design of her subject and her research.

In further comparing Richard, Arabella, Anthony and Stephanie's cases, it was seen that Arabella, Anthony and Stephanie focused on developing a similar kind of TPCK in their students, where 'p' stands for students' professional identity, as opposed to pedagogy. In other words, they focused on developing students' technical knowledge for their future professional practice, valuing the use of technology beyond the context of the subject. Richard's case, however, differed somewhat, as he believed that it was

important for students to be exposed to technology for their future professional practice, but that developing students' digital literacy was not his main focus.

In sum, the results of the case studies highlighted two main reasons for university teachers' technology use in teaching: technology integration with a learning-content focus and technology integration with a professional-practice focus. Gina, Tatyana and Ji cases show how their use of technology was mainly driven by their desire for students to understand subject matter and show evidence of learning. Richard saw technology as a professional practice: he believed that technology is inherently beneficial in preparing students for their future profession and saw its use beyond the subject, thus showing the role of technology beyond the immediate environment of the subject. Arabella, Anthony and Stephanie very clearly described how the use of technology is part of students' professional competence and the real business of teaching and learning in their subject area.

Theme 2: Standard vs Advanced Technologies in Teaching

All participants used PowerPoint in their teaching highlighting standard technology use in higher education. However, a number of participants (e.g. Richard, Arabella, Anthony and Stephanie) incorporated additional technologies into their teaching. These technologies were more sophisticated, such as the use of video-based teaching materials, Web 2.0 technologies (e.g. Weebly and Google Sites) and Adobe software. Analysis of the case studies showed that all participants were successful in their technology use, however, this did not necessarily equate to a strong TPCK for innovative technology use in teaching. Thus, this research shows that context is important when integrating technology in teaching. Whilst individuals can be successful in integrating a specific technology into a task or activity, their TPCK may still be limited.

Theme 3: Technology Integration and Institutional Support

Gina, Richard and Tatyana all accessed institutional support to address their limited knowledge of technology. For example, Richard did not have the technological knowledge needed to develop videos; and drew on technical support from Todd. Gina, on the other hand, accessed technical support from Camellia to improve her technical knowledge of Moodle and associated activities. Richard and Gina's cases show how these participants tried to embed the knowledge they sourced from others into their own TPCK. Tatyana's case, however, differed as she drew on her colleague's knowledge and did not embed the knowledge into her own TPCK.

Theme 4: TPCK Development through Reflection and Iteration

Several participants reflected on how their technology-based teaching could be modified to more effectively meet learning objectives or better suit their student cohort. For example, Arabella reported that her use of discussion forums in 2014 were repetitive and not useful for learning. On the other hand, Richard found that his students did not engage in discussion forums and believed this was due to the competitive nature of the degree. Students were reluctant to share their ideas with their peers, thus, influencing how effective discussion forums were in his teaching. Therefore, participants' reflections on their technology-based teaching helped to extend their TPCK. They were able to develop their knowledge of how to more effectively use technology in their teaching and showed evidence of how contextual factors could influence technology use in teaching, Whilst this study showed that TPCK can be extended through reflection, it also highlighted that university teachers can develop their TPCK through iteration as evidenced in Gina's case. Gina continually completed the same types of activities, such as developing discussion forums or developing workbooks with content. Through completing the same types of tasks on a regular basis, Gina was able to strengthen her knowledge of technology within a specific context.

5.2.1.2 Self-efficacy

Theme 1: Constant vs Dynamic Self Efficacy

Cross-case analysis showed that self-efficacy can be constant or dynamic. In Richard's case, self-efficacy was constant. Prior to the start of the semester, he had worked on the design of his subject and created all video-based teaching resources with Todd's help. Gina's self-efficacy, however, grew through the course of the semester. She valued continually extending her technological knowledge and believed that this was important for her future professional practice. She highlighted that time was a factor that affected how often she could extend learning about technology. Tatyana also felt that time influenced her self-efficacy. She felt that to be self-efficacious in technology use she needed to have extensive knowledge of technology. Although Gina prioritised technology use because it was integral to her subject, Tatyana drew on the knowledge of her colleague Carol to complete online activities on Moodle.

Theme 2: Relationship between Knowledge & Self-Efficacy

Drawing on colleagues' knowledge was a consistent finding of this study. Gina drew on Carmen's (TPCK) and Camellia's (TK) knowledge. Richard drew on Todd's knowledge (TK) and Tatyana drew on Carol's knowledge (TPCK/TK). This finding shows that through combining knowledge and addressing gaps in their own knowledge, participants were able to feel more self-efficacious in completing technology-based tasks. In Gina's case, this interaction challenged her TPCK and she worked to continually develop knowledge of technology. Richard also challenged his TPCK with certain technologies, such as Adobe Connect, although this was not the case for Tatyana.

Theme 3: Time and Work Demands

One participant, Tatyana, highlighted the influence of workload and time on her ability to use new and unfamiliar technologies in her teaching. These contextual factors constrained Tatyana's technology use as she was unable to prioritise experimenting with learning technologies and thus, refrained from setting up and engaging with online discussion forums in her subject. Several participants also discussed the impact of institutional factors and/or workplace demands on technology integration. These factors and demands included the mandatory use of Moodle, limited access to discipline-specific technologies and access to institutional support. Gina, Tatyana, Arabella and Anthony highlighted how the university had mandated the use of Moodle for each subject. Richard explained how the institution did not allocate funding to discipline-specific technologies, such as simulations, and explained how this impacted technology use in teaching. Gina and Richard spoke about access to technical support and highlighted how this support enabled technology use in their subject. In sum, the aforementioned institutional factors and/or workplace demands either enabled or constrained technology use in teaching.

5.2.1.3 Value

Theme 1: Online Discussion Forums Promoting an Active Role in Learning

Cross-case analysis showed that Gina and Arabella valued the use of online discussion forums in their teaching. Both felt that discussion forums provided students with an active voice during learning experiences and, further, demanded participation and engagement that was not always possible in a face-to-face environment. For example, Gina valued discussion forums because they required students to actively engage in content, and because they provided a voice to international students. Student dynamics in her degree showed that during face-to-face classes, only five to six students would actively participate in discussion, with other students potentially disengaged and distracted by other tasks, such as Facebook. International students were also hesitant to speak during Gina's face-to-face classes. This finding was consistent with Arabella's case. During the teaching of her postgraduate subject, Arabella found that international students were hesitant to share their ideas in face-to-face settings. She felt that discussion was typically dominated by certain students, and that online forums provided all students with an active voice in learning and gave them the opportunity to share their ideas, perspectives and experiences.

Theme 2: Relationship between Knowledge & Value

Cross-case analysis also showed that some participants valued the use of technology to prepare students for future professional practice. This was seen in Anthony and Richard's cases. Although Richard did not have the technical knowledge needed to develop video-based teaching materials and Anthony did not keep up to date with the latest version of the relevant software, the value they placed on the use of technology allowed these participants to remain self-efficacious and positive in their use of technology in teaching. Both Richard and Anthony knew where they could go to seek support to address gaps in their

technological knowledge, and thus had a strategy to overcome these gaps. For example, Richard could seek support from Todd and Anthony could access information online to learn about the latest version of Adobe.

5.3 Chapter summary

This chapter presented a cross-case analysis of the seven cases of this research. It provided an overview of each case, including participant, subject observed, and technologies used in teaching. It furthermore analysed all seven cases to present the similarities and differences between cases and identify the findings of the research.

An analysis of these cases according to TPCK, self-efficacy and technology value revealed several key ideas. Regarding TPCK, it could be seen that participants used technology in this study for two clear purposes: either for students to learn content or to prepare students for future professional practice. It was seen that multiple knowledge sources were used to integrate technologies. Where there were gaps in one participant's knowledge, they used the strategy of drawing on their colleague's knowledge to ensure that the technology use met its objective and purpose. In terms of self-efficacy, it could be seen that self-efficacy was either constant or dynamic. For the participant who prepared extensively before the semester started, self-efficacy remained constant. On the other hand, for the participant who experienced continued exposure to the same tasks, self-efficacy grew over the course of the semester. Self-efficacy was also seen in the positive attitudes that the participants displayed towards technology use. Those who believed technology use was important but did not have the technological skill or experience in using the tool were able to maintain a positive attitude because they could see the benefit of the tool for either learning or future practice. In terms of value, technology was important for a number of reasons. For example, discussion forums were used to provide evidence of students' learning outcomes and to give all students an active voice in learning. Technology value was also evident in participants' need to prepare students for their future workforce. Students engaged in a virtual example of their workplace or used tools they would specifically use in their profession.

Chapter 6: Conclusion

6.1 Introduction

This chapter discusses the outcomes of the study. It begins by summarising the findings in relation to the research question and presents previous literature to position these findings. Following this, conclusions derived from the findings and limitations of the research are addressed. The chapter concludes by highlighting how the study has contributed to research, theory and practice and suggests areas for further investigation.

6.2 Summary of findings

The purpose of this research was to explore the factors influencing university teachers' decisions to integrate technologies into their teaching. This study addressed three factors: knowledge, self-efficacy and technology value, and examined their impact on technology integration.

The study was guided by the following research question:

In what ways does a university teacher's TPCK, self-efficacy, and value of technology integration influence their use of technology in their teaching?

A qualitative case-study approach was used to explore seven university teachers who each taught one subject; four undergraduate subjects and three postgraduate subjects were observed as part of this research. Data were collected before, during and after one 13-week university semester in Autumn 2015. Teacher interviews and observations of teaching were collected and analysed as primary sources of data. Two interviews (one at the beginning of the semester and one at the end) and six observations (three face-to-face and three online) provided evidence, perspectives and justifications for participants' technology use. These data sources were complemented by subject artefacts and documentation, including subject outlines and assessment rubrics, which were collected by the researcher during online observations. Data collected from this investigation is detailed in Chapters 4 and 5. The key findings of this research are summarised and discussed below in relation to the research question.

To answer the research question of this investigation, the next section will be divided into two parts. Firstly, part one will include three sub-sections. Sub-section one will explore a university teacher's technology use in teaching and the influence of their technological pedagogical content knowledge. Sub-section two will address a university teacher's technology use in teaching and the influence of their self-efficacy. Sub-section three focuses on a university teacher's use of technology in their teacing and the influence of their value. Following this, part 2 answers the research question and presents a more

comprehensive framework for university teachers' technology integration in teaching based upon the findings of this research.

6.2.1 A university teacher's use of technology in teaching and the influence of their technological pedagogical content knowledge

This sub-section is concerned with how a university teacher's knowledge influences technology integration in teaching and learning. Knowledge was examined through an analysis of interview and observational data using the TPCK Framework (Mishra & Koehler, 2006), which seeks to explain teacher knowledge in relation to technology use in teaching and learning. This framework builds on the notion that technology use in a specific educational context relies on the alignment of technology, pedagogy and content. Teachers must be knowledgeable in all three areas to use technology effectively in their teaching (Mishra & Koehler, 2006; Voogt, Fisser, Roblin & Tondeur, 2012).

A key focus of this research was to explore the influence of knowledge on university teachers' technology integration in teaching. TPCK was an appropriate theoretical framework providing a conceptual explanation of the influence of teacher knowledge on technology use in higher education. The selection of this framework allowed an understanding to emerge of how a university teacher can respond to the demands of each knowledge form in relation to the learning environment and its learners. Through analysing teacher knowledge, data were categorised according to each component of the framework (technology, pedagogy and content), with conclusions drawn around interactions amongst knowledge forms.

Four themes emerged from exploring university teachers' knowledge and technology integration. First, knowledge is activated within a specific context. For example, participants demonstrated TPCK at both an activity level and subject level. In one case, TPCK was also evident at the degree level. Second, an individual can draw on others' TPCKs, including colleagues' knowledge and technical support, to address the limits in their own technological knowledge. Third, teachers can reflect on their teaching practice to build upon their TPCK. Fourth, TPCK can evolve through continued practice and exposure to technology. Each of these four themes is discussed in detail below.

6.2.1.1 TPCK activated in specific contexts

Aligning with Mishra and Koehler's (2006) TPCK Framework, this study found that context was a key factor influencing participants' knowledge. In a certain context, specific technological, pedagogical, content knowledge was activated, showing that an individual may possess multiple TPCKs depending on the tasks relevant to their teaching. As this study shows, TPCK was activated within the specific context of each university teacher's teaching. For example, TPCK was found at an activity level (referring to a specific technological task, such as developing a discussion forum or using PowerPoint), subject level (referring to the consideration of technology at an overall subject level) and degree level (referring to the consideration of technology at the overall degree level). TPCK at these levels are interrelated and one may first consider overall technology use at a degree or subject level before enacting TPCK at an activity level. Further, one may consider their TPCK at an activity level before deciding how to progress at a subject level, especially if an individual would like to assess the knowledge they have for specific technology-based activities before designing or redesigning their subject to include technology. In the case of this research, all participants demonstrated TPCK at an activity level and subject level; however, Gina's case was unique in that it also included TPCK at a degree level.

Participants displayed knowledge of specific technologies, suggesting that knowledge of technology is seen at an activity level. University teachers needed to display knowledge of how to teach with each educational technology or institutional technology embedded into teaching. For example, Arabella displayed TPCK for online discussion forums, for Weebly and for PowerPoint. Stephanie displayed TPCK for video, for Google Sites and for online discussion forums. These examples show that within a specific subject, a university teacher may possess knowledge of various technological tools. Thus, knowledge can be activated for individual activities, showing that context is applicable to the use of a single technological tool in teaching.

Participant Ji showed that TPCK was evident across subjects. In Ji's postgraduate subject, simple technologies such as Moodle and PowerPoint were used to support the delivery of subject matter. However, in his interview, Ji also explained the use of more-complex technologies in other subjects he taught (not observed as part of this study), such as gaming. This is an example of how different TPCKs were enacted across multiple subjects that Ji taught. To elaborate, Ji's TPCK can be categorised as both 'simple' (use of mainstream institutional technologies, such as Moodle and PowerPoint) and 'more complex' (use of specialised technologies, such as gaming). This suggests that although TPCK is specific to certain tasks, it may also involve a level of complexity. This complexity may be restricted by subject factors, such as selecting tools that align with content delivery and complexity of subject matter. For example, Ji's case showed that the selection of technological tools in his teaching must align with how he teaches subject matter. Selecting tools that do not support content delivery would consequently not benefit learners. Ji's case suggests that 1) TPCK varies across different subjects, showing variations in the knowledge relevant to the situation; and 2) university teachers may have a more sophisticated TPCK

for certain technological activities or subjects; however, they may be limited in their technology use due to contextual factors, such as subject-matter complexity.

Gina's case also showed the operation of TPCK at various institutional levels. Gina worked in a collegial environment focused on the implementation of a new blended-learning approach across the Early Years degree. She worked in collaboration with her colleagues, specifically Carmen (director of the Early Years program) and other subject coordinators, to bring a consistent, uniform approach to all subjects offered in the degree. Different TPCKs were evident within the design and delivery of Gina's subject; for example, the development of Gina's Moodle site. TPCK was evident not only at the subject level and activity level but also the degree level. At the degree level, Gina drew on the director's [Carmen's] TPCK. Her knowledge guided the design and development of all subject Moodle sites in the Early Years degree for the purpose of consistency in online delivery. At the subject level, Gina's TPCK was shown in her implementation of Carmen's design. Gina needed to show knowledge in applying the director's overall design to her subject Moodle site. At the activity level, Gina needed to have multiple TPCKs for creating and completing different technological tasks, such as discussion forums, online workbooks, recorded lecture material and assessment-submission links. Thus, this finding suggests that TPCK can operate on multiple levels, such as the degree level, subject level and activity level. Multiple individuals can also influence this process and use their knowledge to inform subject design and delivery.

Research investigating the influence of context on how TPCK can be used and understood in higher education is limited (Glowatz & O'Brien, 2017; Koh, Chai & Tay, 2014). Researchers such as Glowatz and O'Brien (2017) and Koh, Chai and Tay (2014) have argued for more research into context, stating that the influence of contextual factors on teachers' conceptions of TPCK, including beliefs or access to ICT, is rarely explored. Instead, research on TPCK has focused more on exploring or characterising the seven knowledge forms of the framework (e.g. Bibi & Khan, 2017; Cox & Graham, 2009). Given that the findings of this research support the notion that TPCK can be affected by contextual factors, further research into this area is required.

6.2.1.2 Drawing on others' TPCK

Several participants worked collaboratively with colleagues or technical support to address their limited technological knowledge. To elaborate, participants worked with colleagues to combine their TPCKs for the purpose of effective technology integration in a given subject or sought assistance from technical support, specifically to develop resources or advance their knowledge about new, unfamiliar technologies. For example, Tatyana worked with colleagues to effectively embed technologies into her teaching. She felt that although she had high pedagogical and content knowledge, she had limited technological knowledge. With this perceived gap in her knowledge, Tatyana drew on her colleague Carol's knowledge to ensure that her subject was delivered successfully to students. Carol taught within Tatyana's subject

and was responsible for developing and delivering online material on Moodle, including monitoring online learning and marking assessment tasks submitted through the subject's Moodle site. Carol's knowledge was evident in the technological tasks she completed on the subject's Moodle site, such as setting up discussion forums and assessment-submission links. Although Tatyana made contributions to the design of the online learning environment, such as discussion forums, she was unable to set this technology up on her subject Moodle site. Thus, this example highlights how two colleagues worked within one subject, drawing on the knowledge of both to design and deliver face-to-face and online learning experiences for students enrolled in Subject 800.

Another example of how participants drew on others' TPCK was through access to support and resources, including professional development and collegial support. For example, several university teachers accessed various types of support, including professional-development opportunities, faculty technical support and subject/discipline technical support. The results of this study suggest that university teachers used one or more of these support mechanisms to develop their knowledge and consequently improve their professional practice. With reference to professional-development opportunities. For example, Gina attended a workshop that focused on evaluating her subject Moodle site. This workshop provided Gina with knowledge of institutional requirements related to the use of Moodle in teaching. Gina and the Early Years team were encouraged by the Early Years director, Carmen, to attend this workshop. Gina's interview highlighted that attendance at this workshop was encouraged to ensure consistency across the Early Years subject Moodle sites and to address the varying levels of knowledge within the Early Years teaching team. It can be inferred that Carmen believed this workshop would assist her staff in developing their knowledge of Moodle.

Richard drew on faculty technical support, specifically Todd's knowledge, to address his limited technological knowledge. Richard wanted to expose students to a virtual environment similar to their future workplace. Given that this resource was not accessible through the university, Richard approached Todd and sought his assistance in creating subject-based resources. In this instance, Todd's support contributed to a team-based approach, as Richard used his pedagogical and content knowledge and Todd used his technological knowledge to create a virtual environment through video. This example shows that Richard and Todd combined their knowledge to lead to the final video products. Thus, Richard did not embed knowledge of video into his mental structures, but instead worked in a team environment, drawing on his colleague's knowledge to effectively develop video-based teaching materials. On the other hand, Richard was introduced to Adobe Connect by Todd, and used this technological tool in his teaching. To do so, Richard needed to develop knowledge of how this technology operated. Thus, this second example shows that context is important in being able to determine the ways teachers will use technology and, consequently, what types of support they will access. Richard did not need to learn how to create and edit videos, as Todd provided this support and uploaded the videos to Subject 400's Moodle site. During teaching, Richard simply needed to bring up the video and press play and pause where

appropriate. However, given that Richard needed to use Adobe Connect during teaching, this required some knowledge of how Adobe Connect worked.

Gina accessed technical support at a subject level. She worked with Camellia, technical support, to develop her technological knowledge. Camellia was employed to provide technical support to the Early Years team due to their implementation of a new blended-learning approach. Gina's case showed that once she sought targeted support from Camellia and engaged in the same tasks frequently, her technological knowledge increased, and she was even able to provide support to her colleagues when Camellia was unavailable. This example illustrates that university teachers may require targeted support that addresses a specific issue or task. A comparison of the cases in this research revealed that some technologies varied across different subjects, and thus specific support catering to the needs of the university teacher assisted with effective technology integration.

Research has explored professional development to build teacher knowledge when teaching with technology (e.g. Ansyari, 2015; Reilly, Vandenhouten & Gallagher-Lepak, 2012; Teclehaimanot & Lamb, 2005). This research highlights that the use of both formal and informal methods for professional development, such as workshops, learning communities and individual support, can positively contribute to university teachers' knowledge development. Teclehaimanot and Lamb's (2005) work addressed the implementation of a faculty development program implemented over a three-year period to support academics (n: 90) in embedding technology into courses, finding that in the first year of the program, strategies to build knowledge through professional development included 'depth, hands-on practice, project-based approach, modeling, examples, ongoing assessments and timesavers' (p. 330). These strategies were implemented into the second and third year, and although workshops were found to be effective, it was seen that some academics needed support beyond these formal workshop opportunities. Thus, the third year included targeted professional development focusing on the specific needs of academics, along with opportunities for mentoring and sharing. The study's overall results showed that the program positively influenced course design and use of technology in teaching. University teachers were also better prepared to deal with challenges that arose due to the integration of teaching in technology. A more recent article by Christie (2016) showed that faculty learning communities (FLCs) have also been used as a professional-development strategy to provide 'supportive educational development…for faculty to develop and maintain their competence and fluency with the use of digital technologies for teaching and learning' (p. 2). Research supporting FLCs has shown that they are a successful method for faculty members to engage in professional learning (Reilly, Vanderhouten & Gallagher-Lepak, 2012), with 93% of faculty members reporting that FLCs improved their knowledge and understanding of e-learning, and 95% also highlighting that FLCs developed their ability to reflect on design and delivery methods for online courses. This research pointed out the different opportunities that university teachers can engage in to develop their knowledge of teaching with technology, and supports the findings presented above.

In sum, drawing on others' TPCK influences teacher knowledge and technology integration. Knowledge is seen as a resource that can be shared as well as developed through support mechanisms. It is through support that university teachers are able to either advance their understanding of teaching with technology or work collaboratively to embed technologies into teaching.

6.2.1.3 Reflection to extend TPCK

Whilst TPCK was not used as a specific reflection tool in this study, findings showed that participants reflected on technology use in their subject. Several participants reflected on how their technology-based teaching could be modified to more effectively meet learning objectives or better suit their student cohort, specifically if student evaluations reported the ineffective use of technology in learning. Thus, participants' reflections on their technology-based teaching helped to extend their TPCK.

Evidence of this reflection was seen in both the beginning-of-semester and end-of-semester interviews. In Arabella's beginning-of-semester interview, she highlighted that in 2014 she had used the blogging tool Blogger in her teaching. However, she had found this tool to be unreliable, and decided in 2015 to use Weebly instead. She found Weebly easier to navigate and more reliable during classroom activities. Arabella also found that her 2014 students did not favour discussion forums, considering them repetitive and not useful to learning. Therefore, Arabella modified her practice in 2015 by inviting students to share their unique experiences related to certain topics in an aim to reduce repetition among responses. Her end-of-semester interview showed that she found this approach to be successful, as shown by the responses students presented on the forum. Richard's reflection at the end of the semester showed that although he wanted students to engage in discussion forums and share their ideas around particular topics or subject content, this did not occur. He believed that resistance to engage in discussion forums was a result of the competitiveness of the degree. Richard decided that he would use Adobe Connect the following year to promote collaboration amongst small groups of students and allow them to develop a sense of collegiality. Gina also demonstrated reflection on teaching. She did not believe that the discussion forums for specific assessment tasks were effective. She decided to remove these forums from her teaching in 2016.

Research undertaken by Krauskopft, Foulger and Williams (2018) has explored the role of reflection on teachers' TPCK development. Whilst their research explored two in-service teachers in Germany, it highlighted that 'using the TPACK framework as an open-ended *practical* tool [prompted] teachers to reflect on the personal perceptions of their professional knowledge' (Foulger & Williams, 2017, p.166). Thus, this study supports the findings of the above research by suggesting that through reflection on practice, university teachers are able to build upon and extend their TPCK.

6.2.1.4 TPCK develops through iteration

Continued practice and exposure to technology-based activities were found to support university teachers' knowledge development. In Gina's case, online observation showed that she frequently completed the same technology-based tasks on her subject Moodle site. She would create weekly workbooks, embed recorded lectures and links into these workbooks and create discussion forums. In Gina's interviews she said that frequently completing tasks allowed her to develop her knowledge, showing that she could embed technological processes into her mental schematic structures. This finding suggests that knowledge development occurs within a specific context, and that continued exposure to the same task over a sustained period of time allows knowledge to be embedded into cognition and readily available for future use (Gerbier & Toppino, 2015). Knight et al.'s (2006) research highlighted that the most common way for university teachers to learn is through engaging in tasks and 'doing their job'. Through engaging in tasks specific to their teaching, teachers can develop situated knowledge based on the task at hand.

In sum, continued practice and exposure to technological tasks allows university teachers to develop their knowledge of specific activities. When they engage in tasks regularly, knowledge will be readily available for future recall.

6.2.2 A university teacher's use of technology in teaching and the influence of their self-efficacy

This sub-section is concerned with how a university teacher's self-efficacy influences technology integration in teaching and learning. Self-efficacy was examined through an analysis of interview and observational data using Bandura's Theory of Self-Efficacy (Bandura, 1977). This theory, a theoretical construct investigating teacher beliefs about their abilities to achieve specific tasks, predicts that an individual will engage in specific activities that they believe they can perform and achieve in certain contexts.

A key focus of this research was to explore the influence of teacher self-efficacy on decisions to integrate technology into teaching. Bandura's Theory of Self-Efficacy was an appropriate framework providing an explanation of teacher self-efficacy and its influences on technology integration in higher education. The selection of this framework allowed an understanding to emerge of how a university teacher's beliefs about their abilities to complete certain technological tasks can influence their technology integration. An analysis of teacher self-efficacy led to conclusions about why teachers feel self-efficacious in their use of technologies in their teaching.

Three themes surfaced from analysing teacher self-efficacy and technology integration. First, technical support was found to be an important factor influencing teacher self-efficacy and, subsequently, their use of technology in teaching. Second, university teachers' previous experience and experimentation with technology led to varying levels of self-efficacy about technology integration. Third, time and work demands were found to be barriers to teachers' ability to learn and experiment with new technologies. These barriers influenced university teachers' self-efficacy and, consequently, their beliefs about their success in integrating technology into their teaching. Each of these themes is discussed in detail below.

6.2.2.1 Technical support

Technical support was found to have an influence on university teachers' beliefs about their abilities to use learning technologies in their teaching. The use of technical support was shown by Gina (Camellia, Early Years program technical support) and Richard (Todd, Faculty technical support). One of the key ways professional staff provided technical support to university teachers was in the area of institutional technologies. For example, in Gina's case, Camellia support her with online activities related to Moodle and Echo360. Through accessing technical support, Gina's self-efficacy gradually developed over time. Another key way that professional staff provided technical support was in the creation of technology-based subject resources. This support was shown in Richard's case, where Todd provided technical support in the creation of video-based teaching materials. Through working with Todd and preparing these video-based teaching resources prior to Subject 400, Richard's self-efficacy was high, as he believed that the technology would work successfully in his teaching. Both of these examples provide

evidence of one-on-one tailored technical support addressing the needs of university teachers and their use of technology in teaching.

Drawing on technical support to use, implement and embed technologies into teaching has been addressed in studies, which have shown that access to professional development and technical support can increase a teacher's self-efficacy (Ageel, 2011; Horvitz, Beach, Anderson & Xia, 2015). Ageel's (2011) research exploring 16 university teachers' use of technology at a Saudi Arabian university found that teachers who had the skills to use technology and had received technical support and training felt that they were more likely to integrate technology into their teaching. Horvitz, Beach, Anderson and Xia's (2015) research exploring 91 professor's online teaching found that faculty development interventions, specifically support and training, can increase self-efficacy related to online teaching. Ageel (2011) and Horvitz, Beach, Anderson and Xia's (2015) research therefore supports the notion of professional development and technical support and their positive influence on university teachers' levels of self-efficacy when embedding technology into teaching practice.

6.2.2.2 Continued use and experimentation

Participants in this study showed varying levels of self-efficacy when it came to learning technologies. These levels of self-efficacy were a result of their previous experiences and experimentation with technology. Several participants felt comfortable using learning technologies they had previously used in their teaching. The more participants engaged with these learning technologies, the higher the self-efficacy they displayed in their confidence that the technology would achieve its intended purpose. Several participants felt highly self-efficacious in using PowerPoint as a presentation tool in their teaching. For example, Gina, Tatyana and Ji said that PowerPoint was used to deliver key ideas to students about a particular topic. They reported having used PowerPoint on a number of occasions in their previous teaching and felt at ease using this tool. Research by John (2015) has shown that perceived ease of use and computer self-efficacy are important factors influencing adoption of technology in teaching. Building upon this, research by Marzilli et al. (2014), explored faculty members' attitudes towards IT use at one university in the United States. 'A mixed-method approach of a faculty-developed, electronic survey [was used] to assess this topic' (Marzilli et al., 2014, p. 1). This research invited participants to rate their technological skills when it came to standardised technologies (e.g. Blackboard, Excel, Word and PowerPoint). The survey item gave faculty members the option to rate their skills as no skill, fairly skilled and expert on a scale of 1 to 9. The range of possible scores was thus 3-27, and the mean score for the group was 21.6. Therefore, it can be suggested that for standardised technologies such as PowerPoint, university teachers generally feel at ease incorporating this technology into their teaching.

Prior experimentation with educational technologies have been seen to positively influence university teachers' beliefs in their abilities to use certain technologies successfully. For example, Stephanie highlighted that one strategy she used when learning new technologies was experimentation. She spent

time experimenting with technology, learning how it worked and exploring its affordances in teaching. Although Stephanie articulated that she might come across issues and problems with technologies, she did not see this as a barrier to effective technology use. Instead, she identified the strategy of seeking support from online forums. This strategy saw that Stephanie used experimentation as a way to build her self-efficacy in using specific technologies, and although there may have been a risk in using a particular technological tool, this did not appear to influence her self-efficacy. Howard and Gigliotti (2016) addressed risk as an important factor affecting technology integration. Technology-related change in teachers' practice can be linked to their beliefs about integration, as well as risk-taking, experimentation and change. Howard and Gigliotti's (2016) research highlighted hat one teacher's abilities to use successful coping strategies in her teaching led to reduced worries about technology integration, as well as an increase in the belief that technology would successfully support student learning. Thus, this study supports the findings of Howard and Gigliotti's (2016) research, as it reinforces that coping strategies and risk-taking can positively affect teachers' technology use in teaching.

Another finding of this research showed that university teachers who displayed a positive attitude towards instructional technologies felt comfortable integrating these tools into their teaching. Previous research has showed that there is a correlation between teacher attitude and self-efficacy towards technology use (Yau & Leung, 2018). This finding was seen in the cases of Richard, Arabella and Anthony, who maintained a positive attitude towards technology use even though Arabella was using Weebly for the first time, Anthony did not stay up to date with the latest version of Adobe software and Richard was using Adobe Connect and video-based teaching materials for the first time in his teaching.

6.2.2.3 Time and work demands

Time and work demands were found to influence the amount of effort a university teacher places on learning how to use new and unfamiliar technologies in their teaching. This finding suggests a barrier to successful technology integration because it highlights the demands placed on university teachers and the complexity of their role in higher education. Given these demands, 'experimenting with technology' may not be a priority for university teachers; instead, other activities such as research may be their focus. For example, Tatyana explained that time was a factor affecting her experimentation with institutional/instructional technologies. Although she described an openness to technology use, she expressed that her workload of teaching, research and administration left minimal time for experimentation; this resulted in her not feeling comfortable completing new and unfamiliar technological tasks, and thus she avoided them in her teaching.

Research by Littrell et al. (2008) has shown that time and preparation can affect teachers' use of technology in teaching. This research, although undertaken on school teachers, highlighted that time dedicated to learning technologies is often limited due to workload demands. Teachers identified that they could use time before school, after school and during planning periods to experiment with technology;

however, this time was generally allocated to other work-related activities. Due to the responsibilities of a university teacher, including administration, teaching and research, some academics may not feel that they have the time to engage in professional learning and experimentation with technologies. To elaborate, Dowdle's (2004, p. 4) paper argued that in the United Kingdom, teaching faculty members reported that the implementation of innovative technological approaches to teaching heightened university teachers' workload, and that they were 'frequently undervalued by management in comparison to…academic research'. Chalmers (2011) also highlighted that prioritising research over teaching activities could be potentially harmful to the quality of student learning outcomes in Australia. Incorporating Technology-Enhanced Learning (TEL) into teaching and learning involves investing time to develop technological skills and resources. To complete this task requires not only professional development but also time to experiment, develop and evaluate TEL strategies. Therefore, time and academic workload serve as a major barrier to the integration of technology in teaching where academics view this process to be too time-consuming (Benson, Anderson & Ooms, 2011; Gregory & Lodge, 2015; Vaughan, 2007) and without recognition from the university in terms of the time and support needed (Matheos, 2010) for best practices and quality student learning experiences.

6.2.3 A university teacher's use of technology in their teaching and the influence of their technology value

This sub-section is concerned with the value that a university teacher places on technology integration in teaching. Value was examined through an analysis of interview and observational data using Eccles et al.'s Expectancy-Value Theory (Eccles et al., 1983), a conceptual framework used to explain an individual's needs, expectancies and values. The theory provides insights into two factors influencing one's decisions: expectancies for success and subjective task values.

A key focus of this research was to explore the value that teachers place on using technology in their teaching. Thus, Eccles et al.'s Expectancy-Value Theory was an appropriate theoretical framework, as it provices a conceptual explanation for the value university teachers place on technology integration in higher education. The selection of this framework allowed an understanding to emerge of how a university teacher's value of technology can either allow or avoid the use of technology in teaching. Through analysing technology value, impacts were categorised according to the value that university teachers placed on different technologies in their teaching.

Two themes emerged from exploring the value that university teachers place on technology integration in teaching. First, university teachers valued technology in their teaching because it helped prepare students for future professional practice. Either students engaged with technologies (Anthony – Adobe products, Arabella – Weebly, Stephanie – Google Sites and video) that they would use in their future practice or technology was valued for showing students a virtual example of their future workplace (Richard – video-based teaching resources). Second, university teachers used technologies that could assist student learning. For example, online discussion forums were integrated into teaching to support students who may have been hesitant during face-to-face discussions (e.g. Gina and Arabella). Each of these two themes are discussed in detail below.

6.2.3.1 Value of technology to prepare students for future of work

Several participants believed that the use of technology in their subject was important, especially when preparing students for future professional practice. For example, Arabella's (Subject 900), Anthony's (Subject 200) and Stephanie's (Subject 101) subjects centred on student engagement with technologies that were relevant to their future workplace. For example, Arabella's subject included the use of Weebly, an educational technology used by teachers in schools. Anthony's subject included the use of Adobe products, which are used by graphic designers and website creators. Stephanie's subject focused on educational technologies, such as Google Sites and video, which are used by teachers in schools. Although these technologies were included in the teaching of their subjects, one consistent finding across Arabella's, Anthony's and Stephanie's cases was that they valued teaching students the purposes and affordances of technology and exposing students to practical experiences with technology in the context

of completing a specific task or activity. These three participants did not value teaching students how to use technologies in a step-by-step manner. Instead, they believed that this was the responsibility of the student.

Stephanie and Arabella both had a strong belief that their subjects should focus on the affordances of educational technologies and the research behind the integration of technologies in teaching, and on preparing students for their future career as teachers. For example, the delivery of Stephanie's subject was separated into three key phases. First, her subject began by addressing the learning theories of Constructivism, Information Processing and Behaviourism. Students were introduced to these theories and how they can be used to frame thinking about technology use in teaching and learning. During this phase, students also engaged in the critical analysis of educational resources. Second, the subject explored contemporary ICT tools to get students thinking about these tools and how they can be used in educational practice. Third, the subject looked at research related to technologies and engaged in further exploration of tools (e.g. social networking, creating websites, spreadsheets, working with data). Arabella's subject included a focus on Weebly. The integration of this tool in her teaching was seen in two phases: modelling of the tool through a class blog and project-based learning (specifically where students used the tool to solve a problem: the creation of a Weebly that evaluated teacher resources). Overall, these examples highlight how technology has been carefully considered in teaching.

Anthony felt that technology use in his subject needed to mirror the future experiences that students would be exposed to in a real-world professional setting. Thus, Anthony's subject included the use of Adobe products, which are used by graphic designers and website creators in the field. In Anthony's subject, his students engaged in project-based learning. They were required to evaluate a pre-existing website and then use Adobe products to present an improved website design. Technology was, therefore, used in a practical manner to assist students in problem-solving in a task similar to what they would complete in their future profession.

Richard (Subject 400) also valued technology in his teaching to assist students in gaining an understanding of their future workplace; however, his method of integration differed. Richard valued the use of technology to create a virtual environment mimicking a clinical setting. He wanted to introduce students to a child case study and allow them to see the interactions between a clinician and client during interviews. Thus, Richard used video-based teaching resources in his subject to show his students a real-world, authentic clinical environment that they would engage with once they entered the workforce.

As the examples above show, several participants in this study were interested in discipline-specific technologies that immersed students in authentic learning experiences relevant to their future workplaces. Arabella embedded the educational tool Weebly into her teaching; Anthony invited students to evaluate a pre-existing website on the internet and redesign this website according to theoretical principles of design

using Adobe; Stephanie wanted students to create an educational website, a task they might complete in their future profession as a teacher, and Richard created video-based teaching materials that allowed students to experience a real-world clinical workplace. These examples show that discipline-specific technologies are important in developing quality teaching and learning experiences focused on preparing students for their future workplace. Healey (2000) states that within the higher education context there is a growing demand for the development of teaching according to the needs of the individual disciplines. He notes that teaching methods and approaches vary between discipline areas, and that teachers need to provide opportunities for students to learn the knowledge, discourse and skills of their subject (Healey, 2000). The current study found that a number of generic institutional technologies were readily available for teachers at the university; however, this was not the case for discipline-specific technologies. Richard initially wished to use an online simulation to mirror the workplace of a clinical psychologist; however, this technology was not available at the university. Instead, he created video-based teaching resources to address the unavailability of his chosen discipline-specific technology.

In higher education, policy and guidelines around the use of specific technologies can present a barrier to technology integration. Although teachers may value the use of certain technologies in their teaching, these may not be accessible and supported by their university and its stakeholders. Russell, Malfroy, Gosper and McKenzie (2014) highlighted that 'developing strategic plans for the integration of learning technologies is complex in a higher education environment where there is competition for resources' (p. 1). They further commented that the 'review of changes in the three universities [that participated in their study] has shown less change in support for academic-led technology use than in deployment of institutional technical systems' (Russell, Malfroy, Gopser & McKenzie, 2014, p. 13). Their research concluded that 'University staff development and curriculum development systems are both constrained by factors that may be impossible to control or predict – such as funding regimes, political priorities and demography (Russell, Malfroy, Gosper & McKenzie, 2014, p. 13). Because of this, teacher use of technology is harder to deal with than IT infrastructure and technical upgrades to the university online learning management system'. Therefore, this presents an issue of how to use discipline specific-technologies within teaching and learning, as these resources and support are limited within higher-education institutions. Given the importance of these specific technologies and the benefits they can provide to teaching and learning, this area needs further attention.

6.2.3.2 Value of technology to help students in subjects

This research showed that when technology supported student learning and promoted active engagement in learning, it was embedded into teaching practice. Several participants described how technology assisted learners or gave them the opportunity to participate in learning. For example, both Gina and Arabella felt that online discussion forums on their subject Moodle sites were important. They believed these forums gave all students an active voice in the learning process, which was not always

feasible in a face-to-face environment. Some students, including international students, were hesitant during face-to-face discussions, and thus did not readily contribute their ideas in this context. Gina valued discussion forums for two reasons: first, to give students an active voice in learning, and second, to collect evidence of students' learning outcomes, which was not always possible during large group discussions. Similarly, Arabella valued discussion forums as they gave all students a voice and allowed them to engage in learning. These examples suggest that both Gina and Arabella were motivated to include discussion forums in their teaching because they saw the value of this task in supporting student learning and engagement.

Research undertaken by Miniaoui and Kaur (2014) on a small group of undergraduate students at a university in Dubai supports the use of discussion forums in teaching, especially when students are hesitant to share their ideas in face-to-face environments. These researchers found that discussion forums invited students to express their viewpoints on topics in a space within which they felt most comfortable. In addition, students who engaged regularly in topic discussion forums were found to achieve better results than students who did not engage in them. Students who participated in these forums were also found to be able to reflect on their learning and identify what they knew and what they still needed to learn. Thus, this research by Miniaoui and Kaur (2014) highlighted that discussion forums can present as a valuable tool for teaching and learning, reinforcing the ideas of Gina and Arabella and their motivations behind the use of discussion forums in their teaching.

6.3 Research question: In what ways does a university teacher's TPCK, self-efficacy and value of technology integration influence their use of technology in teaching?

This study uncovered variations in technology use across the cases due to contextual factors and differences reported by participants in terms of their TPCK, self-efficacy, and technology value. As shown through the findings of this research, context is intricably linked to the development of knowledge, beliefs and value, and is highly individualised for each university teacher in their own instructional environment (Cox & Graham, 2009; Phillips et al. 2016). There were multiple contextual factors that influenced technology integration in the study, such as *institutional factors* (e.g. access to institutional technologies, university wide goals and objectives for technology integration, university teacher's workload requirement), *degree/program factors* (e.g. degree goals and objectives, discipline specific technologies and technical support), *subject/unit factors* (e.g. student background, subject matter, teaching experience) and *activity factors* (beliefs and attitudes, technical support). These contextual factors were considered by university teachers in the integration of technology in teaching and, thus, context impacted the knowledge that was activated at a specific time. Porras-Hernandez and Salinas-Amescua's work on TPCK outlined three hierarchial levels that 'conceptualise the effects of contextual factors, both proximal and distal, in an organised and systematic way' (Rosenberg & Koehler, 2015, p. 189). The findings of this study support the work of Porras-Hernandez and Salinas-Amescua as it shows that multiple contextual-based levels impact technology integration. In this regard, context is more than just a setting where teaching and learning occurs rather it is a crucial component of technology integration and teachers must possess contextual knowledge (Mishra, 2009). Thus, this research has shown that contextualisation is important due to the variations that exist between various subject matter, their tools and specific pedagogical practices all within a single institution.

This study was guided by three theoretical constructs to provide a lens to investigate how teachers integrate technology and make decisions about what technology to use. Based on the findings from this study, Figure 6.1 presents a model to explain the interplay of these three constructs and the contextual factors that emerged from this study.

Figure 6.1 – Framework integrating theoretical constructs based on the findings of the research

The revised framework highlights the multiple levels that influence technology integration in higher education. As mentioned above, these levels include institutional factors, degree factors, subject factors and activity factors. How these factors are visually presented in the model show that there are multiple layers that can influence technology integration, some in a more direct manner (e.g. activity, subject and degree level) and others at a boarder level, such as institutional factors. These factors, however, are inextricably linked and have an influence over one another in the sense that university-wide objectives and workload requirements can impact technology use at a subject and activity level. Further, across all levels there were some factors in common, such as access to technology, beliefs and attitudes and professional development/technical support.

The relationship amongst the three theoretical constructs has been included in Figure 6.1. This framework considers various combinations of value, self-efficacy and knowledge as reported by the participants of the research. To further explore these relationships, three examples and their relevance to the model above are presented:

1. High self-efficacy and value can influence the decisions one makes about technology integration. Further, if the individual presents strong TPCK this combination can lead to successful technology integration.

In relation to the above model, Stephanie's case showed high technology value and high self-efficacy for technology use which influenced her decisions about technology integration in her teaching. Stephanie also had a sophisticated TPCK, which showed that she had an in-depth understanding of how to combine technological pedagogy and content to enable successful technology use in the context of Subject 100. Multiple contextual factors influenced Stephanie's technology integration, such as prior experience and experimentation, her research on educational technology and her strong beliefs about how technology should be use in her subject to support students' future professional practice. Thus, strong self-efficacy, high technology value and a sophisticated TPCK can enable technology use in teaching, however, this technology use is carefully considered within the context of a specific subject to ensure it meets its intended purpose.

2. Self-efficacy and knowledge may be evident, but an individual may not value technology use in the specific context of their subject; this can lead to minimal technology use or avoidance.

   In relation to the above model, Ji's case showed a different relationship amongst the three constructs. Whilst Ji reported high self-efficacy and high TPCK, there was low technology integration in his subject. Ji did not believe that technologies could be used innovatively in his teaching of Subject 700 due to the complex nature of subject matter. Thus, Ji appeared to have low value for technology integration and his case highlights the crucial role that context plays in determining whether teachers integrate technologies into their teaching or subsequently avoid their use. Even though Ji reported high TPCK, this could be challenged as he did not demonstrate a sophisticated TPCK for technology integration in his subject. Further investigation is needed to see whether these constructs and their relationship would vary among multiple subjects taught by the same university teacher. Thus, whilst a university teacher may possess the knowledge and self-efficacy to use technologies in their teaching, they may not value technology integration and this could lead to low levels of technology integration or avoidance.

3. High value may be evident but an individual could have limited technological knowledge, therefore requiring support from colleagues or technical support to increase their self-efficacy.

   In relation to the above model, Richard's case showed that whilst a university teacher may value the use of technology to prepare students for future professional practice, they may have limited knowledge or self-efficacy to realise this goal independently and thus may seek support to embed technologies into their practice. In Richard's case, he did not possess the technical knowledge and drew on the expertise of Todd. Through working with Todd, Richard's technical knowledge developed, and this positively impact his self-efficacy. Therefore, the three constructs were evident in Richard's case and whilst his value remainder high his knowledge and self-efficacy

developed over the case of the semester showing that these constructs do not have to be fixed throughout the course of a semester but can vary depending on contextual factors, specifically support from others.

In sum, the above model shows the influences of knowledge, self-efficacy and value on the participants' technology integration. These three factors, however, operate within situated instances and thus, this research has more clearly outlined the role of contexual factors on university teachers' decisions to integrate technology into their instructional practice. It has outlined that these contextual factors either enable or constrain technology integration to varying degrees. Thus, this research has found that all three factors are important for university teachers' technology integration; however, they varied between cases depending on context and interactions that occurred in particular ways within certain environments.

6.4 Contributions to theory, research and practice

This research aimed to explore the influences of three factors on university teachers' decisions to integrate technology into teaching. To do this, knowledge, self-efficacy and technology value were explored in the context of teaching in higher education. Rich case studies of seven university teachers who each coordinated one subject in Autumn 2015 were investigated. Four undergraduate (Gina, Richard, Anthony and Stephanie) and three postgraduate (Tatyana, Ji and Arabella) subjects were observed; all participants taught at a single site: one Australian university in NSW.

A comprehensive conceptual framework that drew on three theoretical constructs was used to guide this research. These theoretical constructs were Mishra and Koehler's (2006) Technological Pedagogical Content Knowledge (TPCK) Framework, Bandura's (1977) Theory of Self-Efficacy and Eccles et al.'s (1983) Expectancy-Value Theory. TPCK was used to explore teacher knowledge, specifically the interactions between three knowledge forms (technology, pedagogy and content) and how they influence technology integration in teaching. Bandura's Theory of Self-Efficacy was used to investigate teachers' self-efficacy and their ability to complete specific technological tasks. Eccles et al.'s Expectancy-Value Theory was used to address the influence of value on university teachers' decisions to adopt technology, specifically in relation to whether they believed technology was or was not important to the teaching of their subject.

A collective case study approach provided a detailed and holistic account of each of the seven university teachers' technology integration. Data were collected through interviews and observations before, during and after one 13-week university semester. Two interviews (one at the beginning of the semester and one at the end) and six observations (three face-to-face and three online) provided evidence, perspectives and justifications for participants' technology use. Subject artefacts and documentation collected from

online observations provided complementary data enabling rich accounts of the learning context. Each case study was analysed in multiple stages using cross-case analysis aimed at identifying themes and trends that existed amongst participants' subject design and practice, including knowledge, self-efficacy and 'value of technology' when integrating technologies into teaching.

Findings related to knowledge and its influence on university teachers' decisions to integrate technology into their teaching highlighted four key themes. First, TPCK is situated knowledge, which is activated within a specific context. In this study, technological, pedagogical and content knowledge was evident at an activity level, subject level and degree level. Second, TPCK can serve as a knowledge resource where university teachers combine their knowledges or seek technical support from institutional staff. In this study, participants who had limited technological knowledge drew on the knowledge of their colleagues or institutional staff, such as accessing technical support to facilitate the use of technologies in their teaching. Third, TPCK has the ability to serve as a reflective tool. Whilst this study did not use TPCK as a way for university teachers to reflect on their teaching, the findings indicated that teachers reflected on their practice, showing that they extended and built upon their TPCK. Fourth, TPCK evolves through continued practice and exposure to technology. Through constantly engaging in the same technology-based practices, TPCK is strengthened.

Findings related to self-efficacy and its influence on university teachers' decisions to integrate technology into their teaching presented three key themes. First, professional development and technical support were found to be important factors influencing teacher self-efficacy and subsequently, use of technology in teaching. Second, university teachers continued used and experimentation with technology led to varying levels of self-efficacy and beliefs about technology integration. Third, time and work demands were found to be barriers affecting teachers' abilities to learn and experiment with new technologies. These barriers influenced university teachers' self-efficacy and consequently their beliefs about their success in integrating technology into their teaching.

Findings related to technology value and its influence on university teachers' technology use in teaching highlighted two key themes. First, technology was used to prepare students for future professional practice. Students either engaged with technologies that replicated the tools they would use as professionals or were introduced to a virtual example of their future workplace. Second, university teachers used technologies to assist student learning. This was seen through online discussion forums, where all students were given an active role in learning, which was not always achievable during face-to-face discussions.

To date, research investigating the influence of all three factors – knowledge, self-efficacy and 'technology' value on university teachers' decisions to integrate technologies into teaching – is not available. This research drew on these factors to explore the nature of technology integration. While it

was not the intention of the study to attempt to combine these framings, by using them alongside each other it was possible to identify some emerging relationships between them, and thus to reveal a more comprehensive framework and an in-depth understanding of decisions about technology use in higher education. Supporting evidence from this research has shown that all three factors (knowledge, self-efficacy and technology value) influence technology integration, and that a relationship amongst them exists. For example, three ways in which these factors interrelate are detailed below.

Technical support and experimentation with technologies were shown to have an influence on participants' perceived knowledge of educational technologies, and consequently their self-efficacy. The more knowledge participants gained through seeking support for and experimenting with technology, the more comfortable they felt in its use. For example, Camellia provided technical support to Gina for specific tasks she was completing on her subject Moodle site. Gina's interactions with Camellia were seen to support Gina's knowledge development in the use of technology. In addition, Gina also experimented with Moodle-based activities and completed tasks regularly. Through these two methods, Gina's knowledge continually developed, and her end-of-semester interview showed that her self-efficacy had increased over the course of the semester. Without valuing the use of Moodle and its associated activities in teaching, Gina would not have embedded this tool in her practice. She articulated that Moodle supported students' learning in multiple ways (for example, online discussion forums provided all students with an active voice in learning and allowed students to show evidence of learning outcomes and reflection on professional practice). Thus, this example illustrates that through first valuing Moodle, seeking support and participating in experimentation, Gina was able to develop her knowledge of Moodle and use it successfully in her teaching.

For some participants, limited knowledge did not present a barrier to technology integration. For example, Richard, Arabella and Anthony did not have extensive knowledge of the technologies they wished to use in their teaching. Richard did not have experience creating video-based materials, Arabella had limited experience in using Weebly and Anthony did not keep up to date with the latest version of Adobe. However, these participants valued authentic learning environments, especially environments that would prepare students for future professional practice. Thus, given that they valued technology that supported student learning, they were willing to take the risk of using new technologies (or updated versions of technology) in their teaching. Further, all three displayed a positive attitude towards their chosen technologies throughout the duration of the semester. Therefore, even though these participants had limited knowledge, this did not appear to negatively influence their self-efficacy. The value they placed on integrating technologies was high, and this influenced their positive attitude towards their chosen technological tool.

Tatyana had limited knowledge of technology, and this hindered her self-efficacy, even though she valued the use of technology in her teaching. She expressed that her workload of teaching, research and

administration did not allow time for experimentation with technologies. Although she felt an openness to technology use and valued its use in teaching, she did not feel comfortable completing technological tasks successfully. She felt that to integrate technologies successfully in her teaching, she needed to have a high level of knowledge. Thus, this finding makes a theoretical contribution as it illustrates the use of multiple theories to capture a more holistic picture of a teacher's rationale to integrate technology in their teaching.

Practical implications of this research have been highlighted for universities and university teachers. A practical implication for universities is that this research highlights the different types of support that university teachers in the study accessed. The two main types of support were seeking technical support to use technologies in teaching and allocating technology-based tasks to others (e.g. colleagues) to complete. Generally, when university teachers sought assistance from technical support they either invested time in learning how to use technology (and extending on their knowledge) or worked collaboratively with technical support to develop subject-based resources. On the other hand, when university teachers allocated a task to their colleague to complete, such as creating discussion forums on Moodle, the colleague would complete the task, with responsibility shifting from the university teacher to their colleague. This has implications for universities because it highlights the different types of support accessed by university teachers and how universities can support teachers with technology integration in teaching. Findings of the research also highlighted some potential barriers to technology integration, such as limited time for university teachers to learn how to use technologies or stay up to date with the latest software, as well as access to discipline-specific technologies. This is important for universities to consider because it has an influence on the types of technology-based tasks undertaken by university teachers and how innovative they can be in their use of technology.

A practical implication for university teachers is the potential for TPCK to be used as a reflective tool when integrating technology into teaching. Whilst TPCK was not a specific reflection tool used in this study, the interviews showed that participants reflected on their teaching. This suggests that TPCK can potentially be used as a model to drive teachers' technology integration and reflection. Recent literature addressing TPCK as metacognitive awareness suggests that alongside developing teachers' TPCK, there could also be a focus on developing an understanding of what they know and what gaps still exist in their knowledge (Krauskopf, Foulger & Williams, 2018, p. 155; Krauskopf, Zane & Hesse, 2015). Thus, this implication could provide university teachers with a way to reflect on and address knowledge gaps about teaching and learning with technology.

In comparison to previous literature which only addresses either one or two factors instead of the three factors explored in this research, this study provides a more comprehensive way to examine a university teacher's decisions and rationale in implementing technology. Previous research has not examined all

three factors in a qualitative study providing rich accounts of each university teacher's use of technology in teaching. Instead, TPCK has been extensively researched in schools and on pre-service/in-service teachers mainly using quantitative methods, such as surveys and questionnaires (e.g. Jang & Tsai, 2012; Koh, Chai, Hong, & Tsai, 2015; Schmidt et al., 2009). Thus, this study has contributed to research through, first, exploring university teachers' use of technology in higher-education classrooms. Second, it has used a more comprehensive framework combining knowledge, self-efficacy and technology value to explore the influence of these factors on teachers' decisions to use technology in teaching. Third, it has used qualitative methods to provide university teachers' perspectives, explanations and justifications for either using or avoiding technology in their teaching.

Overall, this research has provided insights into the influences of knowledge, self-efficacy and technology value on university teachers' decisions to integrate technologies into their teaching. It has contributed to theory, research and practice through providing a more comprehensive framework for examining the influences of knowledge, self-efficacy and technology value; it has used an exploratory case study approach to investigate teacher decisions surrounding technology integration; and it addresses the types of support university teachers seek and the potential of TPCK as a reflective teaching tool.

6.5 Limitations of the study

The following section details the limitations of this research, specifically those associated with its methodology and findings. These limitations relate to the number of participants and the nature of qualitative data-collection methods.

The research was undertaken in one Australian university, involving seven participants. The number and nature of participants presented both strengths and weakness. Given that only seven university teachers participated in this study, the researcher was able to closely track each participant and provide a more in-depth account of their technology use. Further, given the diversity of participants in this study (e.g. age, lecturer experience, previous technology use), this provided different accounts of the ways university teachers were using technology in their teaching of a specific discipline. Although in-depth cases were presented on these participants, one key limitation was evident. Given the small sample size of participants and the fact that only one site was explored, it may be difficult to generalise the findings of this research to other contexts and universities. Further, all participants of this research were volunteers. This may suggest that they may have been more willing to make changes to their practice because they were particularly interested in teaching.

Given the nature of this research, qualitative data-collection methods were used. The two primary sources of data collected during this study were interviews and observations. Through the use of interviews, the researcher was able to draw on the perspectives and experiences of the participants and gather data on their thinking when integrating technology in their teaching. Therefore, interviews focused on the participants being able to recall past experiences and discuss their processes of thinking. To assist this, data collection was scheduled over the course of one university semester and was based on a subject that the participants coordinated. Two interviews were held: one at the beginning of the semester and one at the end. The aim of scheduling multiple interviews close to the time the subject was taught was to increase the participants' ability to recall experiences. Further, the use of multiple interviews allowed the researcher to better understand the processes and thinking involved in the participants' actions and decisions. However, given the nature of interviews, participants' subjectivities may be evident during this process. One additional point to address is the inexperience of the researcher and possible subjectivities that may thus be evident. Although the researcher planned how she would address each interview and was cautious not to influence the participants' responses, her inexperience with the interview process may have led to her missing the opportunity to ask specific questions and to unintentionally affect the participants' responses.

Observations were another source of data collected during this research. This data source was included because it allowed the researcher to observe the actions of each participant when teaching. The researcher was able to document what occurred when the participants were teaching in a face-to-face and online environment. This type of data source required the researcher to be able to observe what the

participant was doing and record this information in the form of field notes. Three face-to-face and three online observations were undertaken to capture multiple instances of teaching. To minimise any unintentional subjectivity, the researcher's field notes during face-to-face observations recorded all events from the beginning through to the end of the tutorial/workshop or lecture, and time stamping was used. For online observations, all detail included on the participant's Moodle site was included and any changes made in sequential observations were noted. It is important to note that the inexperience of the researcher could have affected this process and thus there is a chance the researcher may have missed recording some specific details in her field notes. In addition, interview and observational data were complemented by subject artefacts and documentation, including subject outlines and assessment rubrics, which were collected by the researcher during artefact analysis of online material

6.6 Further research

This study used a qualitative case study approach to investigate the influences of knowledge, self-efficacy and technology value on university teachers' decisions to integrate technology into their teaching. Through an examination of seven university teachers who each taught one subject (either undergraduate or postgraduate), the study used interviews and observations to capture information about how these teachers integrated technology into their teaching. A key strength of this research was the exploration of seven university teachers' technology integration through case-based research that provided in-depth accounts, perspectives and experiences of each participant, therefore allowing new areas of interest and issues to arise. Although the ability to generalise the findings of this research are limited due to a small sample size at the one site (all seven teachers working at one Australian university), the findings provide significant contributions to an area that had yet to be investigated. Some possible directions for further research are explored below.

6.6.1 Exploring knowledge, self-efficacy and technology value together

To date, no research has examined the influence of all three factors (knowledge, self-efficacy and technology value) on university teachers' decisions to integrate technology into their teaching. Findings of this research suggest that knowledge, self-efficacy and technology value all influence university teachers' decision-making when integrating technology into their teaching, and thus a relationship amongst these factors was evident. The interplay between these factors was seen in this study through two keys ways. First, while a university teacher may possess the knowledge and self-efficacy to integrate technologies into their teaching, their value of technology within the context of their subject may be minimal, leading to technology being used in simplistic ways. Second, a university teacher may value technology use in their teaching and possess knowledge of teaching and pedagogy, but have limited technological knowledge, which can lead to their turning to technical support or colleagues in their department to complete technology tasks successfully.

This research has provided a more comprehensive way of examining university teachers' decision-making around technology and provides a rationale for implementing technology in teaching. Thus, given that this research is the first of its kind to combine the three theoretical constructs (Mishra and Koehler's TPCK, Bandura's Self-Efficacy and Eccles et al.'s Expectancy-Value Theory), further research into this proposed comprehensive framework is warranted. Thus, additional research evidence is needed to support or refute the findings of this investigation.

6.6.2 Extending to other contexts

This research explored seven university teacher case studies within one Australian university. Thus, the findings of this research may not be applicable to other contexts and universities. The research focused on one specific university context; further investigation into how university teachers embed technology into their teaching across multiple sites is warranted. Further, this research also explored university teachers working within the disciplines of education, arts, psychology and IT. Research exploring university teachers working across other disciplines in higher education is needed.

Another interesting finding that emerged was comparisons between subjects taught by a single university teacher. These comparisons highlighted that different technologies may be valued in the teaching of specific subjects depending on factors such as the complexity of subject matter. Therefore, although this research provided evidence of how university teachers used technology in one of their subjects, further research is needed to investigate university teachers teaching with technology across multiple subjects, specifically to see whether variations in technology use are evident.

6.6.3 Investigating technology use over an extended period of time

This research investigated seven university teachers who each taught one subject, either an undergraduate or postgraduate subject. Each university teacher was observed teaching the subject over the course of one 13-week university semester. At the end of the semester, teacher reflections highlighted how university teachers would modify their practices when teaching the subject in the following year. Thus, further research is needed to observe a university teacher's teaching with technology in a single subject over an extended period of time to see how they modify their teaching with technology.

6.6.4 Institutional technologies vs. discipline-specific technologies

Findings from this research showed that one participant wanted to use a technology specific to his discipline (online simulation). He believed that this technology would support student understanding of assessment in a clinical setting. However, this technology was not readily available at his university.

Instead, the research showed that his institution offered a number of general technologies that could be used across a number of discipline areas. Thus, further research is needed to see the value that university teachers place on general institutional technologies versus discipline-specific technologies and how this may influence decisions around technology use in teaching.

6.6.5 Drawing on others' knowledge

Findings from this research showed that university teachers drew on the knowledge of others to assist their technology integration, specifically knowledge of their colleagues and technical support. Further investigation into the types of support that positively affect teachers' technology integration is required. A lesson learnt from this study is that support varies. It can be offered within teaching teams, such as degree teams working to implement technologies consistently across a degree or subject teams working together to successfully use technologies in a single subject. It can also be offered at the institution and faculty levels to help university teachers develop resources or learn how to use technologies in their teaching. Exploring the perspectives of colleagues and technical support may also provide valuable insights into this area.

6.6.6 TPCK and its potential as a reflective tool

This study used TPCK as a conceptual framework to understand university teachers' knowledge in the context of teaching in higher education. Reflections made by teachers showed the potential of TPCK to move beyond a framework for technology integration to be used as a reflective teaching tool. If teachers are aware of the factors influencing their decisions to use technology in teaching, this could influence their self-awareness and reflection on practice. Thus, further research is warranted in this area.

6.6.7 Student dynamics and technology integration

The influence of student dynamics on technology integration in teaching requires further investigation. For example, some participants stressed the integration of technology into teaching to give all students an active voice in learning. Thus, research that explores the influence of this contextual factor on teaching is needed in order to understand its effect on teachers' decision-making. Further, capturing student data could also provide valuable insights, such as student perspectives on the quality of learning and how it prepares them for future professional practice.

6.7 Chapter summary

The purpose of this research was to investigate the influences of knowledge, self-efficacy and technology value on university teachers' decisions to integrate technologies into their teaching. A review of previous literature had shown that in higher education technologies have become widespread and institutions are expecting university teachers to use technologies to enhance the quality of teaching and learning

(Goodyear, 2015). This, however, has not been the case, as university teachers' technology integration varies. With this understanding, this research study explored the nature of university teachers' decision-making when integrating technologies into teaching with a specific focus on the influences of knowledge, self-efficacy and technology value on this process. Rich case studies of seven university teachers who each coordinated one subject over the course of one 13-week university semester were investigated. A comprehensive conceptual framework, drawing on three theoretical constructs, was used to guide this research. These theoretical frameworks were Mishra and Koehler's (2006) Technological Pedagogical Content Knowledge (TPCK) Framework, Bandura's (1977) Theory of Self-Efficacy and Eccles et al.'s (1983) Expectancy-Value Theory. TPCK was drawn upon to explain teacher knowledge, Bandura's Theory of Self-Efficacy was used to explain teacher self-efficacy and Eccles et al.'s Expectancy-Value Theory was used to explain the value that university teachers place on technology use in their teaching.

A collective case study approach provided a detailed and holistic account of each of the seven university teachers' technology integration. A case-study approach suited this research because it explored each teacher's design and delivery of one particular subject in a natural setting (Creswell, 2018; Merriam, 1998; Yin, 2003). By using this approach, the researcher developed a deep understanding about complex relationships, as well as the participants' experiences within the setting to enable multiple realities to unfold. Data were collected before, during and after one university semester through interviews and observations. Two interviews (one at the beginning of the semester and one at the end) and six observations (three face-to-face and three online) provided evidence, perspectives and justifications for participants' technology use. Subject artefacts and documentation collected from online observations provided complementary data that enabled rich accounts of the learning context. Each case study was analysed in multiple stages and cross-case analysis aimed to identify themes and trends that existed amongst participants' subject design and practice, including their knowledge, self-efficacy and technology value when integrating technologies into teaching.

The findings of this study suggest that knowledge, self-efficacy and technology value all influence university teachers' decisions to integrate technologies into their teaching. The key findings of this study can be summarised as follows:

- University teachers' knowledge of technology is grounded in a specific activity. In this study, knowledge of technology was seen at an activity level, subject level and degree level. Thus, context plays an important role in influencing the knowledge that is activated at a specific time.
- TPCK can serve as a knowledge resource where university teachers can combine their knowledge or seek technical support from institutional staff to embed technologies effectively into their teaching. In this study, some university teachers with limited technological knowledge drew on the knowledge of their colleagues or institutional staff, such as technical support to learn how to use technologies, develop technological resources for their teaching or work in a team-

teaching environment in which they combined their knowledge to effectively deliver subject matter to students.

- Whilst this study only used TPCK as a conceptual framework to understand teacher knowledge, evaluations of teaching showed that university teachers' reflections allowed them to extend their TPCK.
- TPCK evolved through continued practice and exposure to technology. In constantly learning about technologies through practice or understanding how these technologies can be used in teaching, participants strengthened their TPCK.
- Self-efficacy was enhanced through technical support. This influenced teachers' use of technology in their teaching.
- Continued used of and experimentation with technology led to varying levels of self-efficacy and beliefs about technology integration.
- Time and work demands were found to be barriers to teachers' ability to learn and experiment with new technologies. These barriers influenced university teachers' self-efficacy, and consequently their beliefs about their success in integrating technology into their teaching.
- Technology was used to prepare students for future professional practice. Students either engaged with technologies that replicated the tools they would use as professionals or were introduced to a virtual example of their future workplace.
- Technologies were used to assist student learning. This was seen through online discussion forums, where all students were given an active role in learning, which was not always achievable during face-to-face discussions.
- The relationship among knowledge, self-efficacy and technology value were seen in two ways:
    - While a university teacher may possess the knowledge and self-efficacy to integrate technology into their teaching, they may not value technology use in the specific context of their subject; this can lead to minimal technology use or avoidance.
    - A university teacher may value technology in their teaching and possess knowledge of teaching and pedagogy, but have limited technological knowledge, therefore requiring support from colleagues or institutional technical support to increase their self-efficacy.

These findings are a significant addition to the literature surrounding university teachers' technology use in their teaching. The findings of this research provide implications for future teachers' technology integration in various discipline areas and suggest areas for further research. Given that minimal research is available in this area and a new comprehensive framework for investigating teacher knowledge, self-efficacy and technology value in higher education has been proposed, there is still more that needs to be learnt and investigated in this area.

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Appendices

Appendix A - Participant Information Sheet

PARTICIPANT INFORMATION SHEET FOR UNIVERSITY TEACHERS

TITLE: *Exploring the influences on university teachers' decisions to integrate technology into their teaching*

PURPOSE OF THE RESEARCH

This is an invitation to be involved in a research study conducted by PhD student Miss Amanda-Rita Gigliotti at the University of Wollongong. The purpose of this research study is to explore the influences of confidence, value and knowledge on Australian university teachers' decisions to use technology in their teaching. This study will provide an understanding about how context shapes university teachers' decisions to use technology.

INVESTIGATORS

Miss Amanda Gigliotti	Professor Sue Bennett	Dr Shirley Agostinho
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(Student investigator)	(Supervisor)	(Supervisor)

METHODS AND DEMANDS ON PARTICIPANTS

If you consent to participate, some of your teaching will be observed and you will be asked to participate in interviews during the University of Wollongong's Autumn Semester 2015. During this semester, the researcher will conduct six classroom observations (i.e. during tutorials, lectures, workshops/seminars, online observations) and two 45-minute one-to-one interviews. If you agree to participate in this study, you will be asked interview questions covering topics related to your teaching and technology use in both your undergraduate and postgraduate subjects.

Typical examples of interview questions include:

- What technologies do you use in your teaching?
- Can you give me an example of how you use these technologies in your teaching?
- Do you think that the tasks students complete can be achieved without the use of technology?
- Are you confident using these technologies in your teaching?

I wish to audio-record each of the interviews and collect artefacts from your Moodle site that represent your use of ICT in your teaching.

POSSIBLE RISKS, INCONVENIENCES AND DISCOMFORTS

Participation in this research is voluntary; you are free to withdraw from the research study at any time by contacting Miss Amanda-Rita Gigliotti or Prof. Sue Bennett. All responses will be kept confidential and all data collected will be stored securely in a locked filing cabinet and password protected computer in the School of Education, Faculty of Social Sciences. Your refusal to participate or withdraw your consent from this study will in no way affect your employment or relationship with the University of Wollongong. If you choose to withdrawal your consent, your data will be removed from the study. Further, if you choose to participate in this study, no foreseen risks to participants have been identified.

FUNDING AND BENEFITS OF THE RESEARCH

Findings from this study will be published in a PhD thesis, as well as educational journals. These findings may also be presented at conferences or presentations. Confidentiality will be assured for all participants

through the use of pseudonyms and the reporting of only general information about the participants and their teaching in the case study data.

If you have any questions about the research, please contact Miss Amanda-Rita Gigliotti on 02 4221 4178 or at arg597@uowmail.edu.au or Prof. Sue Bennett on 02 4221 5738 or at sbennett@uow.edu.au.

ETHICS REVIEW AND COMPLAINTS

This research has been evaluated by the Human Research Ethics Committee at the University of Wollongong. If you have any concerns or complaints about this research, these can be addressed to the Ethics Officer, Human Research Ethics Committee, Office of Research, University of Wollongong on 02 4221 4457 or rso-ethics@uow.edu.au.

Thank you for your interest in this study.

Appendix B – Beginning-of-semester Interview Schedule

Beginning-of-semester interview

University teacher:
Faculty:
Date:
Time:
Interviewer:

Hello, thank you for agreeing to participate in today's interview. Your participation will help provide valuable insights into how context shapes university teachers' decisions to integrate technology into their teaching. To begin, with your permission, I would like to record this interview. This recording is for accuracy only and the responses you provide will be kept confidential. The recording will be transcribed and you are able to review this transcription at any time and have any part of the interview removed. You can also choose to withdraw from the study at any time, as participation is voluntary. If you withdraw from the study, your relationship and employment with the University of Wollongong with not be affected. Would it be okay if we use the full hour today?

Do you have any questions before we begin the interview?

1) What is your current role at UOW?
    a) How long have you been in your current role?
    b) Have you worked anywhere else apart from UOW?
2) What teaching are you doing this session?
    a) What postgraduate and undergraduate subjects are you teaching? Can you tell me about these subjects? What is the purpose of these subjects? How are they taught?
    b) Are you the subject coordinator, tutor or lecturer of these subjects?
    c) How have you designed the subjects you teach? Did you have any support in the design of your subject(s)? Did you receive any technical help in the design of your subject(s)?
    d) What does your teaching workload look like? How many classes do you have?
3) What forms of technology are available to you to use at the university? (e.g., during lectures, tutorials and/or workshops, when planning your teaching etc.)
4) How are you using technology in your teaching this session?
    a) What role does your Moodle site play in your subject?
    b) What types of activities do students complete in your teaching?
    c) Can you give me an example of how you use technology in your teaching?
5) Why have you decided to use technology in your teaching?
    a) Do you think there is an expectation?
6) Which technologies do you use most regularly in your teaching? Why?

a) Which technologies do you feel most comfortable using? Why?
b) Are you doing anything this semester that you haven't done before with technology?
c) Do you experiment with technology? Do you feel comfortable experimenting?
d) Do you think that some technologies are more important to use in teaching than others? Why? If no, why do you think that technology is not important to use in your teaching?
e) Do you think your teaching would be the same or different if you did not have access to technology? Why?

Thank you for participating in today's interview. If you have any questions, please feel free to contact me. Thank you again for your time.

Appendix C – End-of-semester Interview Schedule

End-of-semester interview schedule – Arabella (02 June 2015)

Thank you for allowing me to be a part of your subject this session. It has been a pleasure observing your teaching. I have some questions that I would like to ask you today about your teaching and technology use. If it is okay, I would like to record today's interview (wait for response). You may review your transcription at any time. Just a reminder, your participation in this study is voluntary. If you choose to withdraw from the study, it will not affect your relationship or employment at UOW. Today's interview will run for approx. 1 hour.

Do you have any questions before we begin?

1. How do you think the subject has gone this session?

Thank you Arabella. I would like to move on to your teaching in the subject. Just to remind you I came along to 3 workshops and I've been following the subject's Moodle site.

2. Let's start with Moodle. Can you tell me about how you use Moodle in your teaching?

    -- Why do you do that?

3. I noticed that you posted the subject outline and lecture slides on your Moodle site. Can you tell me about this?

    -- Why do you do that?

3. I noticed that you used weebly in your teaching. Can you tell me about that?

    -- Why do you do that?
    -- Is this similar to your teaching in other subjects?

4. I noticed that each week students participated in online discussions based on the weekly topic. Can you tell me about that?

    -- Why do you do that?
    -- How did this link to the face-to-face workshops?
    -- Is this similar to your teaching in other subjects?

5. I noticed that you asked students to participate in a survey on Moodle. Can you tell me about that?

    --Why did you do that?
    --Is this similar to your teaching in other subjects?

6. I noticed that Turnitin was available for students to submit their assignments. Can you tell me about this?

    --Why did you do that?
    --Can you tell me about your experience in using Turnitin?

7. I noticed that you used PowerPoint to present key concepts. Can you tell me about that?

-- Why do you do that?
-- What are some of the ways you presented content on PowerPoint? Can you tell me whether you have had experience in using PowerPoint?

8. I noticed that after you presented your lecture in Week 9 you gave students time to create a WebQuest. Can you tell me about this?

--Why did you do that?
-- Is this similar to your teaching in other subjects?

9. I noticed during the second half of the workshop, when students began to explore ICTs, your teaching role changed. You no longer presented content but took on a supportive role and answered students' questions. Can you tell me about this?

--Why did you do this?
-- How did you feel answering students' questions?
-- Is this similar to your teaching in other subjects?

10. Overall, what do you think of how you use technology in your teaching?

Appendix D – Coding framework

Code	Description
1. Background	Main code. No coding under this node.
1.1 Education **1.1.1 Undergraduate** **1.1. 2 Postgraduate**	Main sub-code. This code provides information about each university teacher's undergraduate and postgraduate education.
1.2 Previous industry employment	This code outlines each university teacher's previous employment in their industry or field. **Excludes** University employment.
1.3 Previous university employment	This code provides information about each teacher's previous university appointment. This includes employment both inside and outside of Australia. However, this code is only relevant to previous employment in a full-time academic position and excludes all other university positions. **Excludes** Casual university positions such as a research assistant or researcher are excluded from this code.
1.4 Research work **1.4.1 Australia** **1.4.2 International**	This code outlines the research experience of each university teacher prior to their employment in a full-time academic position. **Excludes** This work is not related to their current full-time academic role.
1. Background ***1.5 Connections to other organisations and institutions***	This code provides detail about the work university teachers have done or are currently involved in with other organisations or institutions. This can be work either nationally or internationally.
2. University of Wollongong ***2.1 Faculty and school***	This code outlines the faculty and school that each academic is employed in.
2. University of Wollongong ***2.2 Academic position*** **2.2.1 Length of time in position** **2.2.2 Role Description**	This code provide detail about each university teacher's position at the university. Including their research role, teaching load and administrative load.
2. University of Wollongong ***2.3 Additional roles at UOW***	This code outlines the additional roles university teachers may have in their faculty and school e.g. head of postgraduate studies.
2. University of Wollongong ***2.4 Connections to other faculties and schools***	This code highlights the connections that university teachers have to other faculties and schools.
3. UOW & Technologies ***3.1 Technology resources available at UOW***	This code provides information about the technologies available to university teachers at the university. This includes the technologies available for the following tasks: ● Preparing for teaching. ● Teaching i.e. during tutorials, lectures, workshops etc. ● Administrative tasks.
4. UOW teaching requirements ***(This relates back to context)***	This code highlights teaching requirements set by the university i.e. uploading subject outlines to Moodle.
4. UOW Teaching **4.2 Influence of context** **4.2.1 University requirements** **4.2.2 University level** **4.2.3 Faculty level** **4.2.4 School level**	This code provides information about different university levels and how they influence teaching and technology use i.e. requirements set at a university level, faculty level and school level.
5. UOW Teaching ***5.1 Face-to Face teaching*** **5.1.1 Tutorial** **5.1.2 Workshop** **5.1.3 Lecture**	This code outlines the types of face-to-face classes (tutorial, workshop, lecture) taught by the university teachers **Excludes** Online teaching

5. UOW Teaching ***5.2 Nature of content & Technology use*** **5.2.1 Graphic Design** **5.2.2 Primary Education** **5.2.3 IT** **5.2.4 Early Years Education** **5.2.5 English as a Second Language** **5.2.6 Psychology**	This code highlights the impact of content on the way that technology is integrated into teaching.
5. UOW Teaching (Subject observed only) ***5.3.1 Moodle & Administration***	This code highlights examples of how Moodle is used by university teachers for administrative purposes i.e. to send messages to students in the subject observed**.**
5 UOW Teaching (All subjects) ***5.3.2 Moodle & Administration***	This code provides examples of how Moodle is used by academics for administrative purposes across all their subjects i.e. to send messages to students.
5 UOW Teaching (Subject observed only) ***5.3.3 Moodle & Teaching Activities***	This code outlines how university teachers use Moodle for teaching purposes- **only for subject observed in Semester 1 2015.** **Excludes** Administrative tasks
5 UOW Teaching (All subjects) ***5.3.4 Moodle & Teaching Activities***	This code outlines how university teachers used Moodle for teaching purposes across all their subjects-**except subject observed.** **Excludes** Administrative tasks
5. UOW Teaching (Subject observed only) ***5.3.5 Moodle & Discussion forums*** **5.3.5.1Communication** **5.3.5.2 Collaboration between peers** **5.3.5.3 Response to course content**	This code provides information on the ways in which the academics have created discussion forums on Moodle (this refers only to the subject observed in Semester 1 2015). This may refer to activities involving communication of ideas, collaboration amongst peers and response to materials such as readings or web materials i.e. online handbook related to early years education.
5. UOW Teaching (All subjects) ***5.3.6 Moodle & Discussion forums*** **5.3.6.1 Communication** **5.3.6.2 Collaboration between peers** **5.3.6.3 Response to course content**	This code provides information about the ways in which the academics have created discussion forums on Moodle (refers to all other subjects taught by academics except subject observed). This may refer to activities involving communication of ideas, collaboration amongst peers and response to materials such as readings or web materials i.e. online handbook related to early years education.
5. UOW Teaching ***5.4. Moodle & Blended learning*** **5.4.1. Use of technology** **5.4.2 Influence on teaching**	This code provides information about blended learning (an initiative implemented across early years courses). It will provide detail about the structure of this course and the use of Moodle to support learning.
5 UOW Teaching ***5.5 Subject design*** **5.5.1 Comfort levels when designing subject matter** **5.5.2 Influence of Assessment** **5.5.3 Sharing subject design between academics**	This code provides information about the ways in which academics have designed the subjects they teach. It also provides information about how their levels of comfort influence their ability to design new ways of teaching the subject matter and also how assessment influences this design. Further this code also highlights when participants in the study received information about how the subject was taught by previous academics.
5 UOW Teaching **5.6 Influence of context** **5.6.1 Student dynamics**	This code provides information about how specific groups of students have influenced subject design or technology use.
5. UOW Teaching **5.6 Influence of context** **5.6.2 Availability of resources**	This code provides information about how the availability of tech resources have impacted upon teachers' decisions to use technology in their teaching.
5. UOW Teaching **5.6 Influence of context** **5.6.3 UOW Platform**	This code provides detail about the platform used at UOW and how this influences the tasks that academics can complete and the types of resources they can provide to their students (i.e. the format of these resources pdf, Word etc).
5. UOW Teaching **5.7 Assessment details**	This code provides information about the assessment tasks created by academics for their students. This relates specifically to the subject that I observed last semester. It includes both technology and non-technology-based assessments.
5. UOW Teaching **5.8 Turnitin**	This code provides information about how academics have used Turnitin in their teaching. It also includes detail about their skills with using Turnitin, as well as the positives and

5.8.1 Experience with turnitin **5.8.2 How academic uses Turnitin** **5.8.3 Positive impact of Turnitin for teaching** **5.8.4 Challenges of using Turnitin** **5.8.5 Student preference**	challenges associated with using this technology. Further, it identifies student preference i.e. whether students like receiving electronic or paper-based feedback.
6. Learners **6.1 Student preparation prior to class**	This code provides details about the preparation students need to do before their class each week. This does not specifically relate to technology, but the students may complete these tasks using devices such as iPads etc. This may include reading articles, completing tutorial questions.
7. Technology **7.1 Experimentation with technology (personal)** **7.2 Experimentation with technology (teaching)**	This code provides examples of academics' willingness to experiment with technology for both personal and teaching purposes.
7. Technology **7.3 Learning how to use technology** **7.3.1 Courses, workshops** **7.3.2 Tech support person** **7.3.3 Support from colleagues**	This code provides information on how academics learned to use technology. This includes previous courses taken by academics and workshops they have attended. This also includes tech support available in each faculty and support from colleagues.
8. Capabilities **8.1 Student Capabilities** **8.1.1 Student technological abilities & impact on tasks set**	This code highlights the skills that students must have to complete the technology-based activities set by an academic. This therefore may require the academic to have knowledge of their students or understand how content guides learning. It is also important to understand the context e.g. how groups of students influence technology use.
8. Capabilities **7.2. Academic Capabilities**	The code identifies the academic's technological capabilities in the context of teaching.
9. Enablers	This code provides information about what academics are able to do with technology.
10. Challenges **10.1 Technological Abilities**	This code focuses on issues academics face in regard to their technological abilities when using technology in teaching.
10. Challenges **10.2 Availability of resources**	This code focuses on issues academics face in regard to the availability of resources when using technology in teaching.
10. Challenges **10.3 Confidence**	This code focuses on issues academics face in regard to their confidence when using technology in teaching.
11. Value **11.1 Teaching- referring to content and pedagogical approaches**	This code highlights the value that academics place on using particular strategies in their teaching i.e. whole class discussions. group work etc. **Excludes** Moodle Technology tools i.e. microphone (lectures), desktop computers. computer labs etc.
11. Value **11.2 Teaching & Technology Tools**	This code highlights the value that academics place on using technology in their teaching i.e. computers & programs available e.g. Powerpoint, microphone etc **Excludes** Moodle
11. Value **11.3 Teaching & Moodle**	This code highlights the value that academics place on using Moodle for teaching purposes.
11. Value **11.4 Technology**	This code highlights whether academics finds technology to be an important part of everyday life and whether they find technology to have a positive or negative- general statements.
12. TPCK	This code provides identifies instances of TPCK.
13. Emergent	This code highlights additional quotes that may be of importance.