A beliefs centred professional development program to support the use of educational technology

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Dedication

To the hope of second chances.

To the power that comes from surrendering to the truth within.

To the light that guides my road to freedom,

I don’t understand you, but I feel you and I thank you for giving me the chance to learn to be me.
Abstract

Out of the many professional development (PD) models described in the literature to support technology integration practices in higher education, only a small number report visible influences on enhanced uses of technology for teaching (Kane, Sandretton, and Heath, 2002; Lawless and Pellegrino, 2007). This is often attributed to the lack of resources, time, competencies or to teachers’ pedagogical beliefs and attitudes which may present a barrier to PD outcomes (Ertmer, 2005). This study set out to design and implement a PD program based on reflective practice, which aimed to enhance the use of educational technology in higher education. The influence of the PD program on teachers’ beliefs, Pedagogical Technological Content Knowledge (TPACK) and use of educational technology was investigated.

The program of research began with a thorough literature review from which six critical elements were identified that informed the design of the beliefs centred PD program. TPACK was then used as the conceptual framework to understand and guide the investigation into the technology integration practices of university teachers. The overarching goal of this PD program is to create awareness about the beliefs that inform the pedagogical decisions of university teachers, so they could identify improvement areas, and subsequently motivate them to enhance their teaching practice and uses of technology.

The PD program was implemented over three iterations following a Design-Based Research approach and mixed methods were employed to assess the outcomes of the PD program. Nine case studies were examined and the findings of each case study were integrated into a comprehensive narrative to determine the alignment between what teachers think, what they know and what they do in their individual teaching practice.

The findings of the cross-case analysis, suggest a positive influence of the PD program in teaching practice towards more student-centred approaches, an
increase in self-efficacy of participants regarding their own teaching abilities, and an improved quality of technology integration in curriculum designs. It was also revealed that beliefs and knowledge have distinct influences on teaching practice. Because teacher beliefs can act as tacit and often unconscious filters of information (Ertmer, 2005; Pajares, 1992), teacher beliefs may have a greater influence on teaching practice than knowledge alone. It is, therefore, argued that an oversight of teacher beliefs in the design of PD programs to support the use of educational technology, may have detrimental effects to successful PD outcomes to be sustained in the long term.
Declaration

This is to certify that:

• This thesis comprises only my original work towards the Ph.D. doctoral degree;
• Due acknowledgement has been made in the text to all other material used;
• This thesis is less than 100,000 words length, exclusive of tables, references and appendices.

Lis María Conde Hernández

November 2019
# Glossary of Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tr>
<td>PD</td>
<td>Professional development</td>
</tr>
<tr>
<td>TPACK</td>
<td>Technological, Pedagogical, Content Knowledge</td>
</tr>
<tr>
<td>LD</td>
<td>Learning design</td>
</tr>
<tr>
<td>LMS</td>
<td>Learning management system</td>
</tr>
<tr>
<td>TIAI</td>
<td>Technology integration assessment instrument</td>
</tr>
<tr>
<td>TIM</td>
<td>Technology integration matrix</td>
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Acknowledgement

This thesis is the result of a collection of moments shared with a group of people who supported, guided and believed in me throughout this process. I am grateful for your time, your patience and the wisdom you have shared with me.

I would like to thank my supervisors Professor Gregor Kennedy, Associate Professor Kristine Elliott, and Dr. Linda Corrin. This road was not easy, but you have taught me by example that the best people make the best professionals. Thanks to you, I now feel comfortable in admitting when I don’t know something. Know that your voice resonates in my mind, “slow down”, “be more circumspect”, “do better”. By watching you work, I learned wisdom that goes beyond my Ph.D. and I will always carry your teachings like a lucky coin.

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Conference Presentations


*Note:* this ASCILITE conference paper provides a summary of the evidence-based elements that informed the design of the PD program developed as part of this doctoral program of research. These elements are outlined in section 2.6. The paper also provides a summary of the first iteration of the PD program, which largely resembles the description in chapter 5.

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1 Introduction

1.1 Statement of the problem

Technological innovations have influenced almost all industries, including education. The challenge for higher education is finding methods to support the knowledge and competencies of university teachers to effectively integrate technology into teaching practice while meeting the needs of 21st-century learners. This has made professional development (PD) a priority, attracting the attention of practitioners and researchers around the globe (Harris and Jones, 2010; Lawless and Pellegrino, 2007; Parr and Timperley, 2010; Runesson and Högskolan i Jönköping, 2015). As a result, there are many published empirical and conceptual studies on PD efforts to support the technology integration practices of teachers. Yet, there are still overarching concerns with the quality of the learning-teaching process due to claims of insufficient evidence-based approaches to incorporating technology into instruction (Lawless and Pellegrino, 2007). There also seems to be a consensus in the literature pointing to contextual constraints, such as lack of resources including time and money, as well as teacher competencies and beliefs, as the biggest obstacles to enhanced technology integration practices.

In addition to limited resources to support the professional development of teachers, contextual constraints can also relate to the changing nature of higher education. Nowadays, teaching staff have to adapt to: larger and more diverse student populations; rapid technological innovations that influence curricula; pressing demands for flexible learning; additional expectations in areas such as research; added roles such as subject administrators; and increasing demands to design curricular tasks or manage technological tools. In addition, teachers are expected to ensure quality and accountability. All of these perceived priorities may leave teachers with little time to invest in improving their own teaching practice.
In the context of higher education, there is also a tendency to employ subject matter experts as teachers, often with little consideration of their pedagogical experience. Moreover, university teachers are not always provided with sufficient professional development. In Australia, more than half of university teaching is done by sessional staff (Hamilton, Fox, and McEwan, 2013; May, Strachan, and Peetz, 2013). This particularity can result in teachers whose knowledge of teaching comes from their own past experiences as learners, rather than from appropriate preparation for their role (Ferman, 2002). As such, teachers may try to replicate or avoid their own student experiences in their teaching practice. They can also be unaware of their own approaches, which means that when confronted by pedagogical challenges in higher education, “existing predispositions may emerge” (Blackley and Sheffield, 2015). These predispositions can reflect surface approaches to teaching and learning which may potentially limit the success of the teaching-learning process.

Individuals’ beliefs are at the root of predispositions and assumptions, and are often shaped through accumulated experiences (Pajares, 1992). In the case of teachers, beliefs are considered to be one of the greatest barriers to technology integration practices (Ertmer, 2005). The reason is that beliefs act as unconscious filters that inform pedagogical decisions and actions (Boschman, McKenney, and Voogt, 2014; Ertmer, 2005; Pajares, 1992). Teacher beliefs are also a relatively unexplored research area due to the difficulties in making beliefs explicit in order to explore, measure, and evaluate them.

In the current study, a focus is on pedagogical beliefs, understood to be implicit suppositions about students, learning, resources and curriculum content (Ertmer, 2005; Kagan, 1992; Yuan, 2017). Typically associated with conceptions of teaching, pedagogical beliefs are conceptualized along the student and teacher-centred continuum in which teaching behaviours are characterized in stages ranging from knowledge transmission to learning facilitation (Kember, 1997; Samuelowicz and Bain, 2001).
The relevance of beliefs to professional development for technology integration is that they act as filters of incoming information, so if a suggested strategy does not align with teachers’ beliefs, they are unlikely to implement the newly acquired knowledge into their teaching practice (Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, and Sendurur, 2012; Schommer-Aikins, Duell, and Hutter 2005). For example, if teachers are unaware that they believe they are a source of all knowledge and that it is their responsibility to transfer that knowledge to students, their concern for transferring large quantities of information may make them unlikely to design and implement tasks around active learning. Therefore, guiding teachers to become aware of the beliefs that drive their own teaching practice is argued to be a critical aspect to ensure effective PD outcomes in the long term.

Pedagogical beliefs are but one aspect of teacher beliefs. In the current study epistemological beliefs (beliefs about the source and process of knowledge creation), self-efficacy (confidence about one’s own abilities), and value beliefs (beliefs about associated importance of people, places, and things) were also considered as intrinsic characteristics of the individual that influence teaching practice. The broad focus on belief systems in the current study is but a building block to contribute to a more comprehensive discussion about the elements that influence the complex phenomenon that is teaching practice.

1.2 Significance and aims

This program of doctoral research set out to explore the influence of a PD program on university teachers’ pedagogical beliefs in relation to the use of educational technology. The main aim was to support the pedagogical and technological knowledge received by university teachers. The solution was to develop a comprehensive, flexible and reflective PD program to enhance technology integration practices. The first phase of development started with a thorough literature review which identified six themes that directly informed the design of the PD program. One of the objectives of the program design was to optimize the
facilitation of active, peer-based, collaborative learning through the use of educational technology. Conceptually this objective was addressed through a focus on participants’ curriculum in order to support their learning design competencies.

The second aim of the PD program design was to establish the conditions for teaching staff’s existing pedagogical beliefs to be made explicit. Several reflective strategies were implemented over three iterations of the PD program, which lasted from six to twelve months each, depending on the needs of participants. Pedagogical beliefs were conceptualized based on Kember’s (1997) teaching conceptions continuum and a diagnostic instrument was used to corroborate findings.

A third aim was to improve university teachers’ understanding of the intersection (also known as fit) between Technological, Pedagogical and Content Knowledge (TPACK). TPACK is a knowledge-based framework for technology integration. Research on TPACK suggests that in order to support effective uses of technology in teaching practice, teachers need to have knowledge of their subject matter, to later transform that content knowledge through pedagogical means, while using technological tools to support students’ engagement in learning tasks and assessments (Mishra and Koehler, 2006). Research on TPACK is extensive in K-12 education but not as thoroughly explored with university teachers’ technology integration practices (Harris, 2016).

To accomplish these aims, this doctoral program of research will focus on the following research questions:

1. What are the salient features that characterize an effective PD program in terms of influence on university teachers’ use of educational technologies?
2. What influence does the PD program have on teachers’ pedagogical beliefs and understanding of the intersection between technological, pedagogical and content knowledge?

3. What is the influence of the PD program on university teachers’ effective implementation of educational technology in their teaching practice?

In addition, the contributions of the current study are the following:

1. The development of a PD program that is effective in creating awareness in university teachers of their pedagogical beliefs, while supporting their ability to design, implement and evaluate learning tasks in both blended and fully online contexts.

2. Insights into the role that beliefs play in a fundamentally "knowledge-based" framework (TPACK).

3. Design principles in the form of recommendations for practitioners to guide the development of reflective, TPACK-based PD programs to support technology integration practices in higher education.

### 1.3 Overview of the thesis

This thesis presents a program of research in nine chapters:

Chapter 2 provides an overview of PD in higher education. It explores the nature and context of higher education, including quality standards for teaching and learning. It presents a review of the most common PD models, along with examples of PD approaches implemented in universities around the world. The chapter concludes with a description of the evidence-based design elements that informed the development of the PD program implemented in this program of research.
Chapter 3 is divided into two sections. The first section introduces learning theory including an exploration of educational paradigms and broad pedagogical approaches. The second section focuses on learning design as a method to support design thinking in university teachers.

Chapter 4 provides an overview of teacher beliefs and TPACK. First, the nature and characteristics of pedagogical, epistemological, self-efficacy and value beliefs are introduced. The influence of these beliefs on PD, uses of technology and teaching practice are also explored. The focus of the chapter then turns to the Technological, Pedagogical and Content Knowledge (TPACK) framework. The chapter explores the origins of the framework, the conceptual basis of it, and concludes with suggested models for TPACK development in higher education.

Chapter 5 presents the design of the PD program developed for the current study. It provides detailed explanations of each action taken through an iterative approach.

Chapter 6 provides the methodological basis of the research design for the current study. The current study broadly followed a design-based research methodology and the PD program was implemented and refined over three iterations. Mixed methods were employed to assess PD outcomes in nine case studies and the chapter provides an overview of the data collection methods and analysis conducted.

Chapter 7 includes detailed descriptions of the nine case studies. For each case study, the mixed methods analysis of data is integrated into a coherent narrative.

Chapter 8 presents the findings from a mixed methods analysis conducted across all nine case studies. Patterns emerged in relation to pedagogical beliefs, TPACK, and learning designs. Moreover, the findings pointed to epistemological and value
believes, self-efficacy, motivation and context as intrinsic and extrinsic influences that enable espoused beliefs to be enacted in teaching practice.

Chapter 9 provides a discussion and conclusion. The discussion highlights the meaning of the evidence collected in relation to the research questions, explores implications for research and practice, and outlines the limitations encountered in the current study.
2 Professional Development: Models and Considerations for Effective Implementation

This chapter presents an introduction to professional development (PD) models. The concept of PD is defined, the expectations of the context are described, and the reasons why university teachers need PD opportunities are discussed. There is also a broad introduction to the most common PD models, including examples of PD approaches implemented around the world. The final section describes the evidence-based elements that informed the design of the PD program developed for this program of research.

Given that the development of an in-depth understanding of PD approaches is key to this program of research, this chapter will focus on general models of PD and approaches to influence pedagogical beliefs. However, PD approaches specifically designed to improve technology integration will be outlined in chapter four. Moreover, it is important to note that while the aim of the literature review described in this chapter was to identify appropriate PD models and approaches for higher education, the research on TPACK based PD is extensive in the K-12 context. Therefore, in this chapter, the literature review has been expanded to include the contexts of K-12 and vocational education. While it is acknowledged that the dynamic in each context is different, the intent is to create a deeper understanding of successful strategies to consider in the design of the PD program used in this doctoral program of research.

2.1 Professional development: a definition

The influences of politics, innovation and pedagogy in the higher education context has resulted in a pressing need to support performance and professional growth of teaching staff (Rodrigues, 2005). Throughout the past forty years, institutional support has been labelled as professional learning, staff development, academic
development and professional development. Each label implies different meanings and varies depending on the context.

Professional learning is a broad term often implemented by organizations to help their employees thrive in the conditions they face and is not specific to higher education. The term refers to the critical efforts of organizations to motivate their employees to renew and reinvigorate their approaches to meeting the needs of customers and users (Goddard, Hannon, Peterson, and Temperley, 2014). The lessons learnt from professional learning are often used by companies such as Google (USA), Infosys (India) and the Harris Federation in the UK. More recently, staff development was introduced to refer to learning opportunities made available by school districts and states, and is not specific to universities (Joyce and Calhoun, 2010).

More specific to the higher education context is the term academic development which has also been introduced to describe the methods used to develop academics’ teaching practice. This label most closely describes the scope of the current study, but its use in the literature is ‘theory poor’ (Willison, 2007). Educational development, as coined by the International Consortium for Educational Development (ICED, http://icedonline.net/), and faculty development, as proposed by EDUCAUSE, are also terms used to promote learning opportunities for teaching staff in higher education. Moreover, learning and teaching development is often used in higher education programmes to enhance learning (Trowler & Cooper, 2012).

Due to its wider scope, the more common term professional development (PD) will be adopted in this program of research. PD is defined in this study as “the improvement, support, and development of teaching, learning, assessment, and curriculum. It involves research into higher education, informed discussion and promotion of the scholarship of teaching and learning, in order to enhance higher education goals and practice” (Bath and Smith, 2004, p. 14). Joyce and Calhoun
(2010) claim that the purpose of professional development is to provide a range of learning opportunities for teaching staff to increase their knowledge and competencies within institutions, so that they are better able to respond to their role. The hope is that PD opportunities can create a more collaborative and open culture within institutions.

2.2 The need for professional development in higher education

Although there has been a growing interest in improving the depth and breadth of teaching qualifications for better student outcomes, formal PD programs for university teachers are a relatively recent phenomenon (Ginns, Kitay, and Prosser, 2008). Since the 1970s, PD programs have been introduced in response to the changing nature of higher education. These changes relate to the massification of higher education and increased diversity of student populations, the need to ensure quality and accountability, as well as staying up to date with innovations in pedagogy and educational technology (Land, 2004). The implications of each of these issues for professional development are discussed below.

The last decade has seen significant investment in increasing the number of people attending universities, both globally and within Australia. In the UK for example, the objective has been to enrol at least half the population between the ages of 18-30 by 2010. In Australia, the aim is to support at least 40% of the population between 25-34 years of age to complete an undergraduate degree by 2025 (Hughes and Brown, 2014). The expected increase and diversification of student populations may impose constraints on available resources and access to infrastructure.

The implications for staff of the massification and diversification of student populations include changing student expectations, the need to redesign curricula, shifts in staff and institutional priorities, and altered workplace expectations (Land, 2004). Furthermore, teaching staff may be subject to policies, which impose budgetary constraints or are designed to ensure quality and accountability, in order to progress institutional agendas. PD programs can be used as tools by institutions
to equip teaching staff with knowledge and skills to better respond to the demands of their role.

Supporting PD activities in higher education is critical given that a particularity of this context is that not all teaching staff are trained teachers, which presents a potential barrier to quality and accountability. In Australia more than half of university teaching is done by subject matter experts (SME), often employed on a casual or sessional basis (Hamilton et al., 2013; May et al., 2013). Typically, SMEs are perceived as knowledgeable lecturers due to their discipline-specific achievements, which may overshadow proper consideration of their teaching experience or abilities. What is more, the terms of their contracts may limit the time allocated to PD to support their pedagogical abilities. The implications of this is that some casual teaching staff may have based their teaching on how they were taught themselves as students, rather than from pedagogical preparation (Bennett et al., 2011; Ferman, 2002; Kandlbinder and Peseta, 2009).

The increasing number of casual teaching staff illustrates the need for continuing PD programs and support, due to the fact that being a SME does not always guarantee a person can deliver quality teaching. For a quality teaching-learning process to occur, discipline-specific content first needs to be transformed into activities and assessments to engage students during and outside lectures. PD programs focused on pedagogical and technological knowledge have the potential to foster and/or strengthen the ability of SMEs to transform their content into meaningful learning experiences more confidently (Koehler and Mishra, 2009).

Another important reason to support PD activities in higher education is the interplay between innovative pedagogy and educational technology. In the classroom, the impact of educational technology is evident in the adoption of new equipment, changes to curricula, and the promotion of student-centred pedagogies (Martinez, Rodriguez-Ruiz, and Sampedro, 2005). The need for flexible learning opportunities has also made online learning increasingly common in higher
education. Nevertheless, it has been argued that PD programs to date have been unsuccessful in producing evident improvements in teaching practice, especially in regards to technology integration (Valanides and Angel, 2005). A common criticism of PD for technology integration is the tendency to focus on training for specific software or hardware, rather than on the pedagogical objective behind the use of technological tools (Lawless and Pellegrino, 2007). PD programs have the potential to support university teachers to be able to keep up with technological innovations in pedagogically informed ways, but careful consideration needs to be given to their design.

2.3 Models of professional development

2.3.1 An introduction

There are a broad range of models for the implementation of PD. A PD model is considered to be “a prototype, a pattern that, in education, can be used to create an environment for learning” (Joyce and Calhoun, 2010, p.3). PD models can be formal or informal arrangements of organizational processes and structures to help educators and administrators develop competence to perform in their roles. Joyce and Calhoun (2010) argue that these models often have a view of learning and developing skills for both students and teachers, which are connected to specific objectives. The authors assert that in order to achieve those objectives, PD models need to be clear, practical, disseminable and evaluated to verify PD outcomes.

In the current program of research, there is a distinction made between a family of PD models, PD models and PD approaches. A family of models is understood as a broad category that refers to a set of models known to establish similar dynamics amongst PD participants. On the other hand, a model refers to specific patterns or suggestions of how to design PD programs, while an approach refers to PD programs or activities that follow the guidelines of a model but are designed to respond to a specific context.
Furthermore, in the current study, models of PD in higher education are compared and contrasted following the work of Joyce and Calhoun (2010) and Kennedy (2014), who organized models based on reports of their capacity for supporting professional autonomy (Table 2-2):

Table 2.1 Broad Summary of PD models

<table>
<thead>
<tr>
<th>A family of Models adapted from the work of Joyce and Calhoun (2010)</th>
<th>Model of Continuing PD as perceived by A. Kennedy (2014)</th>
<th>Purpose of Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual Inquiry/Personal Study Efforts,</td>
<td>The training model</td>
<td>Transmission</td>
</tr>
<tr>
<td></td>
<td>The award bearing model</td>
<td></td>
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<tr>
<td></td>
<td>The deficit model</td>
<td></td>
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<tr>
<td></td>
<td>The cascade model</td>
<td></td>
</tr>
<tr>
<td>Personal/Professional services by peers or supervisors</td>
<td>The standards-based model</td>
<td>Transitional</td>
</tr>
<tr>
<td></td>
<td>Peer Review Model</td>
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<td></td>
<td>The coaching/mentoring model</td>
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<td>The community of practice model</td>
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<td>Open-Ended, Local Community activity</td>
<td>The action research model</td>
<td>Transformative</td>
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<tr>
<td></td>
<td>The transformative model</td>
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</tbody>
</table>

The intent of the list above is not to categorize or promote one model as better or worse than another. Rather, it is to provide an advanced organizer so that the characteristics of each model can be further explored in the next section.

2.4 Features of professional development models

The description of each model here will focus on the characteristics, strengths and weaknesses. Models are also organized into families and noteworthy examples of approaches are detailed.

Models of Individual Inquiry or Personal Study Efforts: In this type of model, it is common to offer stipends or short-term leave to help educators generate and capitalize on growth opportunities for themselves. These models function better where a positive, energizing culture is established through strong leadership from the top down (Joyce and Calhoun, 2010). These types of models usually involve
attending a series of workshops or intensive courses to foster curriculum initiatives or instructional techniques. These models are highly dependent on self-development, can take the form of online learning, or capitalize on informal learning. However, depending on the intended method of delivery, some of these models may impose logistical difficulties, as they require funding, time away for the teacher, teaching substitutes, and a clear pathway for the new knowledge to be passed onto the rest of the staff. This family of models include the training, the award bearing, the deficit, and the cascade models. The defining characteristics of each based on the work of Kennedy (2014) is described below:

**The Training Model:** This is considered one of the most dominant forms of PD. It is focused on providing opportunities for teachers to update and demonstrate knowledge and skills. Often led by a subject matter expert, it places participants in a passive role. The main criticism of this model is that it lacks connection to the classroom given it is often delivered in a controlled environment. It also can be perceived as a performance management strategy that tends to overshadow teachers’ specific needs. It is effective in communicating new knowledge, but since it is often highly decontextualized, it fails to ensure that the knowledge is used in practice.

**The Award Bearing Model:** These programs often involve granting participants some sort of award as external validation and quality assurance. They are focused on classroom practice, yet are often criticized for having little focus on evidence-based approaches, despite the strong focus on practice-based teaching.

An example of this model is the Graduate Certificate of Education Studies (GCES) which is an approach implemented by the Centre for Teaching and Learning at the University of Sydney. This approach prepared graduate students to teach in higher education. The course was divided into two parts. The first section explored the principles of teaching and learning in higher education and the second section focused on the scholarship of teaching and learning to engage students more deeply
in scholarly inquiry. The study reported a slight shift in teaching conceptions towards more student-centred approaches as a result of completing this course (Ginns, Kitay and Prosser, 2008). A similar example is the Graduate Certificate of Higher Education implemented by Monash University in Malaysia. This course was compulsory for most lecturers and included four units delivered over two years. A highlight of this program is a faculty learning community is established to provide ongoing support to academics (Chang Tik, 2015).

The Deficit Model: This model is designed to remedy a specific weakness in performance and is commonly labelled as "performance management". It requires somebody to take charge of evaluating and managing change in teachers’ performance often without clear expectations. The main criticism of this model is that it does not address the foundational causes of poor performance in relation to organizational or management practices.

An example of the Deficit Model is the Learning by Design approach implemented by the University of Cyprus (Valanides and Angel, 2005). In this approach, ten secondary science school teachers and two facilitators worked collaboratively through workshops. The PD extended for four months which is reported to have enabled a good understanding of the challenges and needs of teachers in relation to information and communications technology (ICT) PD. The objective of the approach was to support Pedagogical Content Knowledge, but the authors report challenges such as different needs, expectations, skill and knowledge level of participants.

The Cascade Model: This model is common in institutions where resources are limited. It is often based on sending a teacher to a conference or workshop, with the later requirement to disseminate that information to other co-workers. In this model, skills are typically given priority over attitudes and values.
Personal and Professional Services by Peers: This family of models is more complex, involving collaboration. Often a teacher is in charge of getting to know another or several other teachers, diagnose their needs, and try to provide help in deficit areas. The model depends on formal partnerships meant to free staff from the constraints that prevent collective action (Turkich, Greive, and Cozens, 2014). Collaborative time for discussion, data collection, decision making, and support for implementation are critical (Joyce and Calhoun, 2010). Such partnerships may include teaching staff, but also department heads, administrative staff and experts. Some positive aspects are that they facilitate the socialization of new staff, capitalize on existing competencies, and allow for collective action (Dysart and Weckerle, 2015). Some of the negatives may include champion/mentor/coach burnout, lack of incentives to motivate participation, ensuring the sustainability of PD outcomes in the long run and standardization of practice (Grainger et al., 2015). This family includes the standards-based, the peer review, the coaching, and mentoring models:

*The Standards-Based Model:* In this model, standards are defined as “actions with emphasis on evidence-based, and demonstrable practice” (Kennedy, 2014, p. 240). This model aims to create evidence-based connections between teacher effectiveness and student learning. It tends to rely on the behaviourist perspective of learning. Major criticism regards a tendency to undermine teachers’ own capacity for reflective, critical inquiry, it overlooks key issues such as what is the purpose of teaching, and may also be perceived as quality assurance and accountability (A. Kennedy, 2014). Nevertheless, it is argued that a shared understanding of standards allows for a common dialogue among teachers about their professional practice.

An example of this approach is the Teaching Excellence framework implemented by Curtin University (Tucker et al., 2014). Based on the Australian University Teaching Criteria and Standards (AUTCAS), a teaching and learning plan was implemented to improve student learning experiences across the institution. The plan resulted in a university wide understanding of what constitutes “good” teaching and learning and is described as “... integral to evidencing good teaching and is aligned to role
statements for teaching focused, clinical teaching and teaching-research, academic positions” (Tucker et al., 2014, p. 1).

The Peer Review Model: This model is based on formative review and is argued to be an efficient form of teacher development commonly used in higher education. The process is based on an open and collaborative sharing of professional practice. By providing constructive feedback, teaching staff can uncover areas for possible improvement, potentially enhancing commitment to and insight into teaching (Woodman and Parappilly, 2015). If the peer review is done in pairs, the ideal is to match an inexperienced with experienced teaching staff. If the peer review is to be done in triads, the ideal is to include a reviewee, a discipline expert from the same faculty with more teaching experience, and a teaching and learning expert from a different faculty in the university. Participation in this type of model varies from voluntary to compulsory and relates highly to conditions of employment. Some universities have clear academic motivators such as credit towards a certificate, award or promotion, or data that can be used for publications. Some of the positive attributes of this model include development, collaboration and self-assessment. On the other hand, negative aspects may arise if the model is perceived as a management, monitoring or surveillance strategy (Grainger et al., 2015).

An example of this model is the Working in Triads approach implemented by Griffith University. This model involved a reviewee, a more experienced lecturer from the same faculty and a teaching specialist from another faculty who convened to provide feedback to each other (Grainger et al., 2015). This approach was reported to promote self-assessment and collaboration to improve practice, and to be resource and time effective. However, given that no incentives were offered, there was little willingness by academics to participate (Grainger et al., 2015). Similar challenges were reported by Flinders University, South Australia (Woodman and Parappilly, 2015). Flinders University implemented a compulsory program for new teaching staff, that was reported to have improved performance and ensured quality standards (Woodman and Parappilly, 2015). The same benefits were found as a
result of the Lead-In Change Model implemented by three other universities in Australia (Barnard et al., 2015). In this approach, champions, administrative and academic staff participate in collaborative observations.

The Mentoring Model: This model is based on the relationship between an expert teacher and a new staff member, with the aim to provide counselling, guidance and professional friendship (Kennedy, 2014). The objective is to develop competence, reduce attrition, protect and socialize new teachers. There is a focus on confidentiality rather than accountability. In both the mentoring and coaching models, seminars and workshops are provided to help mentors advance their knowledge and teaching competencies so they can provide better support (the suggestion is 10 to 15 days of training a year). Mentors are then responsible for communicating information to mentees. Mentors are often encouraged to provide supervision without formal assessment, and to help mentees move through the following continuum:

- Survival: At this stage the mentor provides support with approaches to teach the curriculum, and focuses on building a relationship with the mentee by providing companionship and advice. Mentors need to be solid teachers, warm, supportive and need to be willing to play the advocate role.
- Maintenance: At this stage the focus is on helping the mentee organize curriculum areas, materials, assessment techniques, and to learn basic, cooperative learning strategies. The new teacher learns to handle situations, manage students, teach and assess at standard levels within the institution. Mentors need a rich toolkit of teaching strategies to accomplish high- and low-order cognitive goals.

![Figure 2-1 The mentorship continuum. Taken from Joyce and Calhoun (2010, p. 43)](image-url)
• **Enhancement:** At this stage the candidate is introduced to more complex, inductive and attainment models of learning, and more sophisticated cooperative learning, including methods to evaluate higher-order cognitive and social outcomes.

• **Redevelopment:** The goal at this stage is to study 21st-century teaching and learning models and implement them, including the evaluation of student learning. The mentor needs to be willing to move beyond his/her current level of knowledge, as well as possess the ability to provide opportunities for the novice to self-reflect, evaluate and improve their own repertoire of strategies.

An example of this model is the Co-Teaching Mentor Model implemented by Curtin University, Western Australia. In this approach, Ph.D. candidates mentored teachers who were experiencing problems with student retention over the course of three years. PD took place in the classroom and teaching responsibilities were often shared (Turkich et al., 2014). Another example of this approach is the mentoring circles implemented by the University of Adelaide (Darwin & Palmer, 2009). This approach is based on a group mentoring dynamic in which twenty academics agreed to meet over a period of six months to peer mentor each other. The study indicates that the benefits were more fully experienced by academics who reported enjoying a more collaborative form of PD. Nevertheless, the approach was reported to result in “…a commitment to attend; confidentiality; rapport between circle members; and voluntary attendance.” (Darwin & Palmer, p. 134).

**The Coaching Model:** Much like the mentor model, the goal here is to improve specific skills and knowledge based on the relationship between a teacher and a more knowledgeable peer. The aim is not necessarily to support new teachers, rather, the focus is on supporting teachers to acquire or refine skill(s), to enhance implementation of curriculum, and to develop action research for improvement across the entire institution. Some critical considerations for both the mentoring and coaching models are the appropriate selection of “champions”, providing considerate training and incentives for champions, and assigning multiple staff.
members as champions to avoid burnout. Similar to the mentor model, the professional coach should take a fellow practitioner through the following stages:

- **Companionship**: At this stage it is essential for coaches to provide nurturing support by creating a safe and analytic space for teachers to reflect on practice and how to improve it.
- **Enhancement**: Through workshops and the coaching relationship, new strategies for managing the classroom, teaching and assessment are introduced with the goal to elevate practice to excellence by reflecting on student learning.
- **Redevelopment**: Both parties study teaching and learning models and implement them, including evaluating student learning.

The TPACK and Practice-Based PD approach implemented by Loyola University and Macob Community College in the U.S is a good example of a coaching model. In this approach, facilitators provided teachers with support to enhance their Technological, Pedagogical, Content Knowledge (TPACK), while peer coaches assisted teachers to implement a subject. Dysart and Weckerle (2015) report that this approach enabled greater comfort and efficacy in lecturer’s ability to teach with technology and helped establish a more open and integrated community of practice in which participating teachers become future coaches.

*Open Ended Local Community Activity*: This family of models involves bringing faculty members together to participate in learning communities of practice (LCP) to reflect on their practice and seek ways of making it better. Joyce and Calhoun (2010) argue that synergy is optimal in groups of four or five participants and the
LCP works best when there is heterogeneity of competences. The authors also claim that the key to this approach is the collective energy, which increases positive affect, and enactment of strategies and teaching skills. As skills and knowledge are identified by the group, individuals are likely to move beyond their existing repertoires. The positive aspect of this family of models is that in collective action, research into and reflection of practice take on more profound levels; it can also nurture professional networks. The negative aspect is that teaching staff have little time to devote to these initiatives. Also, since teaching time is autonomous and separate from the rest of the community, the impact on teaching practice is left up to the individual. The community of practice, the action research, and the transformative models are all part of this family.

*The Community of Practice Model*: Learning through this model involves mutual engagement, understanding, fine-tuning of practice, and the development of a repertoire of practices, styles, and discourses. It is based on a relationship of mutual accountability among those involved (Kennedy, 2014). The suggestion is to promote the gathering of groups with the objective to study their practice. The hope is that collective knowledge and skills overlap and they can learn from each other's practice. The primary mechanism is the discussion and study of student's work, as well as observations of each other's classrooms, so they can explain their practice to one another.

A Community of Practice is exemplified by the Science Interactive Model implemented by Oviedo University in Spain. This approach brings together teachers, scientists and subject matter experts to provide support for teachers to create multimedia resources. Teachers also visit scientific labs to update their content knowledge (Martinez et al., 2005). In this example, teaching practice is improved through continuous support.

*The Action Research Model*: Action research for individuals, small groups and schools involves the development of a democratic decision-making process, a common goal
throughout the organization, and the development of a self-renewing ethos (Kennedy, 2014). Action research is a way of studying what is happening in an organization, agreeing on steps to improve how to teach and relate to students and the community, studying the effects, and then repeating the process. The aim is to identify areas to revise conceptions and go beyond them by refreshing the approach to teaching curricular content. Data is collected and research done by others is studied. Essential to this approach is a continuous confrontation with data and inquiry. As such, it is a cyclic, reflective process focused on understanding what is happening to students, but the information can also be used to improve the skills of individuals within the community (Joyce and Calhoun, 2010).

The Transformative Model: The key characteristic of this model is the combination of strategies to support a specific institutional agenda and power relations. It is not a clearly definable model in itself, as it can effectively integrate the different models described above.

An example of a transformative model is the Sessional Academic Success approach implemented by Queensland University of Technology. This approach involved administrative staff, champions and 2500 sessional academic staff in a faculty-specific coaching effort blended with a community of practice model (Hamilton et al., 2013). This was a university-wide PD effort that was reported to be time and resource intensive, but with visible impact due to the timely support and feedback provided.

2.4.1 Effective professional development activities

There are both formal and informal forms of PD ranging widely in their long-term impact. Ferman (2002) outlines formal forms of PD including action research, publications, workshop attendance, formal training, conference attendance, accessing online resources, mentoring, coaching, project-based work, reflective journals, and collaboration with an educational designer. Informal methods of PD
include conversations with colleagues, readings, informal feedback, mentoring and networking.

There is evidence to suggest that some of these activities can have long-term impacts. Ferman (2002) found that novice lecturers see value in workshops, while more experienced lecturers valued their collaboration with an educational designer. Mentoring and attending conferences were also seen as very valuable, even though little evidence was found for the long-term efficacy of workshops, seminars and courses. Wilson (2012) identified that short courses and workshop attendance were helpful for novice lecturers, and that the type of PD that works best is one-on-one collaboration with a learning designer and/or a mentor. Furthermore, at a faculty level, the formation of communities of practice is optimal for promoting collaboration and to ensure that PD outcomes are sustained in the long term. Informal conversations with colleagues were also identified as highly beneficial.

2.5 Evidence-based design elements for PD to support technology integration practices

The PD program that was implemented as part of the current study was designed according to six broad elements. These elements were identified in the literature as being characteristic of effective PD programs to support the use of educational technology. This was achieved by conducting a literature review using the search terms and databases described in Table 2-3. The inclusion criteria for empirical studies of effective PD programs are also shown.

Note, research on TPACK based PD is not as extensive in higher education, therefore, the literature review was expanded to include the K-12 and vocational education contexts.
<table>
<thead>
<tr>
<th>Focus</th>
<th>Context</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional Development</td>
<td>AND Academic, Teaching Staff, Sessional staff, university teacher, (context) to insert: Higher education, University, Tertiary education, Teachers, k-12 education, Vocational</td>
<td>AND Educational Technology, Computers, eLearning, learning design, Beliefs, Teacher beliefs, TPACK</td>
</tr>
<tr>
<td>Inclusion Criteria</td>
<td>The study is published in English in a peer-reviewed journal article, preferably after 2000, The study explores the implementation of PD approaches/models to improve teaching practice in higher education, The study discusses or reviews PD design principles, The study explores the implementation of PD approaches aimed to enhance TPACK or technology integration practices, The study explores the implementation of PD approaches that intend to make explicit pedagogical beliefs</td>
<td></td>
</tr>
<tr>
<td>Exclusion Criteria</td>
<td>The study was not written in English, The article was not peer-reviewed, The article was older than 1980, The study focused on a different context, especially in industry practices</td>
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From this process, a total of 58 studies were identified. Analysis of these studies resulted in the identification of six broad elements for the design of effective PD programs to support technology integration practices (*Appendix A*). The six elements are: immerse educators in a reflection process; focus on teaching practice; choose appropriate delivery methods; include a careful selection of technical infrastructure; consider organizational culture; and promote collaboration. These six elements became evidence-based guidelines that informed all aspect of the PD program. Each theme is discussed further below.
2.5.1 First element: Promote reflective practice

The ability to reflect is considered an essential principle of good teaching. The idea behind this element is that critical reflection should be taught to and by university teachers, given that reflective practice has been found to accelerate the development of teaching competencies by increasing awareness and confidence (Turkich et al., 2014). The focus of reflective practice is on enabling a continuous assessment of needs and making explicit pedagogical beliefs (Ertmer, 2005; Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, and Sendurur, 2012).

Evidence from the reviewed studies points to considering participants needs and practice (Francom and Reeves, 2010). This implies finding ways to appraise participant's prior knowledge, intentions, motivations, and specific needs, and may take the form of an assessment or diagnostic tool. Considering participants' needs can be critical to the success of a PD activity given that participants may not be willing to invest resources to change or innovate unless they have established a need to do so (Singh, 2014). Moreover, having an initial point of reference to entice reflection can be useful to guide the evaluation of the influence of the PD. Note that cyclical evaluation throughout a PD implementation has been argued to be beneficial to improve the quality of PD tasks, as well as increasing the likelihood of effective PD outcomes (Lehiste, 2015).

The second recommendation related to this element is to provide ongoing feedback. There is conceptual and empirical evidence to suggest that the credibility of feedback on teaching practice is enhanced if provided by a similar, but more experienced peer (Grainger et al., 2015; Joyce and Calhoun, 2010). This can be achieved in PD models such as coaching, mentoring, peer review, or a learning community of practice. If it is a teaching specialist, expert, or another person delivering the PD, the specific recommendation is to share notes of classroom observations and planning with the participants. Students can also be a rich source of feedback. In fact, John Hattie (2011) stresses that the best teachers not only
provide ongoing feedback on learning to their students but also actively seek feedback from them. The specific suggestion is to help teachers develop the ability to attend to and infer from day to day communications if students are in fact having a meaningful learning experience.

Another central recommendation in this element is to make explicit pedagogical beliefs of participants (for more information refer to chapter 4). There is evidence to suggest that a process of self-reflection can help to expose, as well as confront, belief systems. Ertmer (2005) stresses that a change in beliefs results from a “conversion process or gestalt shift” (p.32). This process can be triggered by dissatisfaction with existing beliefs, either because those beliefs are challenged or because new beliefs cannot be assimilated into existing ideas. Bai and Ertmer (2008) also speculate that changes in beliefs are unlikely to occur evenly over time. Instead, the learning process is continuously triggered as existing beliefs are subjected to deeper reflection.

In her seminal work, Ertmer (2005) outlines three categories of PD strategies that may influence a change in beliefs. The nature of each category is outlined below. Moreover, a list of specific suggestions based on the literature review was compiled and is presented in Table 2-4:

- **Personal Strategies:** This category includes strategies that are “facilitated through experience” (Ertmer, 2005, p.33), given that a change in beliefs follows rather than precedes practice. The key is to support teachers to have successful experiences of using educational technology to implement their curriculum tasks. An immediate impact of these strategies may be an improvement in self-efficacy by helping teachers implement small instructional changes before attempting larger ones (Ertmer, 2005).
- **Vicarious experiences:** This category includes strategies based on observing similar, but more experienced and successful peers. This serves both educational and motivational purposes, as exposure to the practice of others
may increase the perceived need to change, reassuring university teachers that experimenting with new strategies may lead to tangible improvements (Ertmer, 2005).

- **Social/Cultural influences:** This category involves creating opportunities for colleagues to have the time to discuss and support each other through the implementation of new pedagogical strategies, as well as new technological tools (Ertmer, 2005). Commonly, these strategies may require allocating time, place and resources for a group of individuals to meet with a goal in mind.
Table 2.3 Potential strategies to make explicit pedagogical beliefs in professional development programs

<table>
<thead>
<tr>
<th>Personal Strategies</th>
<th>Vicarious experiences</th>
<th>Social Cultural Influences</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Videotaped performances: Teachers can watch and reflect on the video recording of their own teaching (Kagan, 1992).</td>
<td>1. Working with knowledgeable peers: more structured PD models such as coaching or mentoring would likely achieve a change in beliefs (Grainger et al., 2015).</td>
<td>1. Professional communities of practice: this is a space where colleagues can meet on a regular basis to discuss new materials, methods, and strategies to support the efforts and possible challenges involved in transforming practices (Ertmer, 2005; Mansvelt, Suddaby, and O’Hara, 2008; Mostert and Quinn, 2009).</td>
</tr>
<tr>
<td>2. Think aloud methods: teachers are presented with opportunities to reflect on and articulate their ideas about what makes a good lesson and talk about ways in which technological tools fit within that (Kagan, 1992).</td>
<td>2. Observing the performance of successful others: either by physically attending or by watching a video of a peer's classroom practice (P. A. Ertmer and Ottenbreit-Leftwich, 2010).</td>
<td>2. Ongoing public conversations with stakeholders (teachers, administrative staff, students) around pedagogical beliefs including discussions on how technology can help achieve enhanced learning outcomes.</td>
</tr>
<tr>
<td>3. Recall: teachers are requested to plan or recall specific classroom events or decisions.</td>
<td>3. Collaboration with peers to form a collective belief or with Learning/Instructional designers, or educational experts (Kim et al., 2013)</td>
<td>3. Ongoing technical and pedagogical support to provide help and guidance for educators to develop confidence and competences with technological tools. (Ertmer, 2005)</td>
</tr>
<tr>
<td>5. Having time to play with technological tools: educators can begin using a specific technological tool to achieve their own goals (Kim, Kim, Lee, Spector, and DeMeester, 2013).</td>
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<td>6. Implementation diary: teachers are suggested to write how they intend to implement their newly acquired knowledge before a PD session ends. They should also be requested to report on their experience during the beginning of the next session (Okseon and Euichang, 2015).</td>
<td></td>
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<tr>
<td>7. Situating PD programs within teacher's context and curriculum</td>
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<tr>
<td>8. Focusing uses of new technology on teacher's immediate needs (Ertmer and Ottenbreit-Leftwich, 2010)</td>
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2.5.2 Second element: Focus on teaching practice

Given that some academic studies have suggested that PD efforts that are technocentric and/or disconnected from the educator’s curriculum or classroom practice tend to be ineffective (Baran, 2016; Lawless and Pellegrino, 2007), the focus of this element is on transformation of teaching approaches rather than on technology training. The recommendation is to employ a practical approach by designing PD activities that are directly based on the teacher’s curriculum for increased relevance. This curriculum-based PD approach could allow for teachers to get support with immediate challenges and authentic problems (Lehiste, 2015).

The second recommendation in this process is to adopt a meaningful technology integration framework. Given that the TPACK framework is reported to have a pragmatic approach to conceptualizing teaching practice, it has the potential to easily integrate theory, research and practice (Lehiste, 2015). Through TPACK, the curriculum guides the PD by informing the technological and pedagogical needs of the university teacher. Learning Technology by Design is one approach that is suggested, as it is conducive to hands-on practice in an authentic, reflective and low-risk environment (Mishra and Koehler, 2006; Dysart and Weckerle, 2015) (For more information on TPACK-based models, refer to chapter 4).

One of the objectives of this element is to deliver “know-how” and “know-why” which can be achieved by modelling effective practices during PD delivery or by creating an environment where educators have access to expert performances (Albion, Tondeur, Forkosh-Baruch, and Peeraer, 2015). Some of the suggested approaches to achieve this objective are peer review of teaching, coaching/mentoring, and participation in learning communities of practice (Grainger et al., 2015; Turkich et al., 2014; Wang, Hsu, Reeves, and Coster, 2014; Woodman and Parappilly, 2015). There is evidence to suggest that these approaches can influence motivation, the capacity to improve instruction, mutual accountability,
and shared goals which enable a common language for analysing instruction (Runesson and Högskolan i Jönköping, 2015).

Another relevant aspect of this element is the ability to evaluate visible changes as a result of PD. Fortunately, with the emergence of the scholarship of teaching, members of the academic community have presented a myriad of appropriate methods to evaluate the effectiveness of a diversity of learning environments (Kandlbinder and Peseta, 2009). A suggested method is design-based research methodology which enables the implementation and evaluation of educational innovations to not only advance theoretical understandings but also to continuously improve the PD approach (Albion et al., 2015). Design-based research urges the use of formative and summative evaluation to refine strategies to increase the likelihood of successful outcomes.

2.5.3 Third element: Consider delivery methods of the PD

This element recommends a careful consideration of the tasks and delivery methods used in a PD program. Some of the possible obstacles to effective delivery methods include failing to seek time commitments from participants, disconnected delivery from classroom practice, overlooking pedagogical beliefs and motivations, as well as lack of organization. In fact, PD approaches for teachers are argued to be most effective when active, reflective, job-embedded, coherent, in-depth, longer in length and link curriculum content to pedagogy (Albion et al., 2015; Ferman, 2002; Harris, 2016; Schmidt et al., 2009; Turkich et al., 2014; Wang et al., 2014; Wilson, 2012).

The main recommendation is to transcend the seminar approach and move away from the transmission models. Ideally, PD would provide opportunities to practice and experience the constraints and affordance of technological tools (Dysart and Weckerle, 2015). Practice time with technological tools is argued to increase metacognitive processes in problem-solving, and/or deepen the understanding of technology as cognitive tools (Wang et al., 2014). To reduce anxiety and ease the
burden of technology integration it is also useful to design a blueprint to model intended designs and to facilitate incremental degrees of complexity in the PD tasks (Wang et al., 2014). It is argued that pedagogical patterns or sample learning designs are conducive to helping teachers create pedagogically informed learning activities (Conole and Jones, 2010).

A specific suggestion is the creation of a constructivist PD environment conducive to deep learning through authentic, situated, hands-on practice. The flipped classroom method, for instance, may not only reinforce delivery through the modelling of best practices but also allows time for reflection and discussion (Wang et al., 2014). It is also recommended that information overload or a hurried pace to instruction is avoided in PD (du Plessis and Webb, 2012). Also, that the facilitator is caring, approachable, competent, a good listener, passionate and should provide clear explanations (du Plessis and Webb, 2012). Furthermore, the facilitator should provide just in time support and should only intervene if requested (Baran, 2016; van Merriënboer, Clark, and de Croock, 2002; Wang et al., 2014).

2.5.4 Fourth theme: Careful selection of technical infrastructure

A careful selection of technical infrastructure is considered critical to helping reduce anxiety and increase willingness to adopt new pedagogical strategies with technology-based tools. The danger is that if the number and functionality of tools are not carefully selected or explored, it may lead to rejection, may divert attention away from the program, or may result in cognitive load due to low skills (Valanides and Angel, 2005).

The first recommendation for this element is to explore the affordances and limitations of technology prior to introducing them to educators and their students (Baran, 2016). As part of the planning process, a real distinction needs to be made between using digital tools as a means to support or achieve learning objectives, and learning tools for the sake of using them (Lawless and Pellegrino, 2007; Mansvelt et
al., 2008). Techno-centric approaches should be avoided. The digital tools used for the PD should be low cost or free, reliable, easy to access and should reduce economic constraints (Campbell, Longhurst, Wang, Hsu, and Coster, 2015; Wang et al., 2014). These tools should also be made available for teachers to work remotely (Conole and Jones, 2010).

The second recommendation is for the use of a website to deliver content, given that it can support the interconnectedness of artefacts and is easily accessible as a reference for PD participants (Conole and Jones, 2010). It can also be used to include resources that model pedagogical strategies within faculties or provide access to expert performances through videos (Baran, 2016). A website can also include a discussion forum to increase communication among peers, potentially encouraging a community of practice (Wang et al., 2014).

2.5.5 Fifth element: Take into account organizational culture

Organizational culture can exert an influence on pedagogical beliefs and PD outcomes. Some of the possible challenges include inadequate administrative support, teaching expectations (Wang et al., 2014), lack of incentives for participation due to preoccupation with budget priorities (McWilliams and Allan, 2014; Rodrigues, 2005), and reluctance to participate from discipline based faculties (Bath and Smith, 2004; Valanides and Angel, 2005). To overcome these challenges, the suggestion is to engage stakeholders in developing a shared vision for the pedagogically appropriate use of educational technology. The aim should be to establish a culture where peer review, networking, strong leadership, and enthusiasm are encouraged (Barnard et al., 2015; Jacqui, Singh, and Schrape, 2011). Another suggestion is to do a needs analysis to compare actual performance of participants to desired performance, and to tailor PD tasks that allow for authentic learning and practical application of suggested strategies while creating a space to discuss ways to ensure an ethical, fair approach to teaching (Owen, 2012; Parr and Timperley, 2010; Willison, 2007).
The most relevant consideration for this element is the need to ensure PD efforts are perceived as quality enhancement rather than quality assurance (Kennedy, 2014). There is empirical evidence to suggest that if PD is perceived as a top-down strategy of quality management, it is likely to trigger negative attitudes or be rejected (Grainger et al., 2015). In fact, it is argued that top-down directives and sanctions are ineffective in creating a safe, non-threatening atmosphere to discuss teaching practice (du Plessis and Webb, 2012; Owen, 2012). Mass emails, for instance, may be ignored or considered too long. This is why it is important to make participation in the PD program voluntary to allow for autonomy and nurture the innate motivation of participants.

2.5.6 Sixth element: Promote collaboration

Collaboration amongst participants can promote ownership of learning and may create a sense of collective improvement. In fact, curriculum development has been found to be more effective if it is a team-based activity (Mostert and Quinn, 2009). Continuous exchange of ideas between peers can influence participants to model, imitate or adopt positive outcomes (Singh, 2014). Such exchange can encourage teachers to reflect on the link between a change in practice and student learning (Robinson, Myran, Strauss, and Reed, 2014). The suggested strategies to established collaboration through PD are the coaching/mentoring method, peer review of teaching and learning communities of practice. Moreover, one-on-one collaboration with a learning specialist is considered the most effective way of influencing teaching practice, while participation in learning communities of practice is considered conducive to sustaining outcomes in the long term (Ferman, 2002).
2.6 Chapter summary

This chapter provided an overview of general PD models, and presented the evidence-based elements that informed the design of the PD program developed for the current study. The aim was to understand the nature of the context in terms of the requirements that need to be considered in the design of PD programs that respond to the needs of university teachers. More PD approaches to support technology integration practices will be discussed in chapter four. The PD program designed for the current study will be described in chapter five. However, chapter three, will now focus on providing an overview of relevant learning theory and learning design as a baseline objective for quality teaching and learning.
3 Learning Design and Theory

This chapter provides a basis for understanding how best practice in learning theory and learning design can be used to create engaging learning experiences for students. The focus is on providing a foundational understanding of the methods of teaching and learning that will be promoted through the PD program implemented in the current program of research. The first section of the chapter explores learning through different educational paradigms, provides an introduction to constructivism and active learning, and outlines essential characteristics of an engaging learning environment. The second section explores learning design from the perspective of how to support teachers’ design thinking.

3.1 Approaches to student learning

Our understanding of learning has been shaped by educational theories. Behaviorism was the dominant theory for the first half of the last century and during this time education and learning was most typically defined in terms of reinforcing students’ ability to demonstrate appropriate behaviours in response to stimuli (Ertmer and Newby, 2013). As such, learning was defined as “an enduring change in behaviour, or in the capacity to behave in a given fashion, which result from practice or other forms of experience” (Schunk, 2012, p. 2). In response to dissatisfaction with behaviorism which mainly focused on observable behaviour, cognitivism paid more attention to individual’s mental processes. Learners came to be seen as information processors and constructors of knowledge based on existing cognitive structures. Through cognitivism, individual students are seen as constantly processing information and features of the environment, and that information is later encoded into long-term memory. The theory of cognitivism helped to ground the understanding of learning as a process of enhancing neural connections, and as such “the aim of all instruction is to alter long-term memory. If nothing has changed in long-term memory, nothing has been learned” (Kirschner, Sweller, and Clark, 2006, p. 77).
During the 1960s, Piaget, one of the most significant proponents of cognitivism, introduced the idea that the learner constructs knowledge progressively from infancy to childhood (Harasim, 2012). Piaget’s perspectives built the foundations for the current paradigm of constructivism, in which knowledge is perceived as a dynamic, changing construct. Later Vygotsky, a proponent of social constructivism presented the argument that the interrelation of knowledge is supported by our social interactions (Sorensen, 2008; Vygotsky, 1978). Under this theory the learner is considered an active participant, creating meaning through a lifelong process of accumulated experiences and interactions (Schunk, 2012; Sorensen, 2008). A social constructivist definition is that learning occurs “as a continual conversation with the external world and its artefacts, with oneself, and also with other learners and teachers,” (Ertmer & Newby, 2013, p. 66; Sharples et al., 2005, p. 7).

### 3.2 Constructivism and active learning

While both the behaviourist and cognitivist theories have had a profound impact on education; the current study broadly adopts a constructivist approach. Constructivist teaching methods encourage learners to discover their own knowledge through an active process of sense making mediated by their current and prior knowledge (Bolliger and Armier, 2013). Memory structures are constantly being updated through assimilation and accommodation triggered by a cumulative history of interactions with the environment, situations and/or peers (Ertmer and Newby, 2013; Schunk, 2012). The premise is that if learners are to be successful in a highly interconnected and complex society, instruction should aim to develop higher order level abilities such as problem-solving, critical thinking, and effective communication skills (Biggs, 1996; Bryceson, 2007). To achieve these goals, the idea is for learning to be situated in real-world experiences (Harasim, 2012). Authentic tasks created around meaningful contexts have been found to facilitate the application of newly learned knowledge across settings, also known as knowledge transfer (Ertmer and Newby, 2013; Harasim, 2012).

Social constructivism is aligned with the following broad pedagogical approaches which are argued to foster deep learning due to their focus on facilitating
interactions (Fullan and Langworthy, 2014). Effective implementation of these pedagogical approaches should take into account learner characteristics and prior knowledge. They also require appropriately challenging environments that provide opportunities for critical discourse among peers to resolve an activity, problem or task (Schunk, 2012). The following broad pedagogical approaches are reported in the literature as conducive to enhancing learning achievement, satisfaction, engagement and/or retention:

- **Authentic learning** is best described as a pedagogical model. Authentic learning tasks are designed to simulate realistic contexts and are argued to promote higher order abilities. In this model the facilitator’s role is supportive, and the outcome is a genuine and worthwhile product (Herrington, Reeves, and Oliver, 2009)

- In **Cooperative learning**, students work in small groups and are responsible for one another’s learning. Cooperative tasks use team goals to promote team success by explicitly stating that the group will succeed only if all team members achieve the learning objectives (Slavin, 1981). The group grade is final and dependent on all members excelling in their individual contributions (Robert E, 2014). This cooperative strategy can be useful to frame positive group work and is argued to motivate peers to help each other excel.

- **Guided discovery learning** is a strategy that may promote critical thinking by engaging students actively in analysing complex situations. Direct instructional guidance is suggested as a way to get students to discover a predetermined goal. Learners usually discover the desired knowledge by studying specific scenarios. The teacher is a facilitator that guides students to reflect and discuss the causes of variation in a possible outcome. This method supports self-directed behaviours and helps students become lifelong learners (Mukherjee, 2015). The discovery of knowledge may lead to a
sense of ownership, and it may facilitate transfer of knowledge to other scenarios (Mukherjee, 2015).

- **Inquiry-based learning** is a group of evidence-based methods focused on learning facilitation. Inquiry-based approaches include *problem-based, project-based, and case-based learning*. Tasks are based on questions or problems which students must answer or resolve, thereby fostering a deep understanding, and promote students’ directed investigations (Aditomo, Goodyear, Bliuc, and Ellis, 2013). With case-based learning, the emphasis is to trigger discussions based on realistic scenarios. It may promote critical thinking and deep processing increasing the probability of retention (Aditomo et al., 2013). Project-based learning places an emphasis on the management and production of products in the real world. Tasks are often authentic to promote engagement and help instil the critical thought process of a practitioner. Problem-based learning is both a pedagogical approach and a curriculum design methodology in which tasks are based on real world issues. Problem-based learning can concurrently develop higher-order thinking or disciplinary knowledge, engage students in active role play as problem solvers (practitioners), provide a deeper, richer learning experience and confront students with a real-world situation (Blackburn, 2015).

- **Flipped Classroom** refers to the practice of assigning foundational content as individual preparation work before class, so that class time is freed up to work on the application of this knowledge through active learning strategies in an environment where students are supported by their teacher and peers (DeLozier and Rhodes, 2017). For example, students could be requested to prepare for a class by watching a video, reading an article, or investigating a topic. In-class active learning strategies might include discussions, role plays, debates, etc. Follow up homework is recommended after class to help students retain information. According to DeLozier and Rhodes (2017) there are two main challenges with the flipped classroom approach. The first
challenge is related to measuring students’ perceptions of learning given that students are often unable to assess their own learning. The second relates to the challenge of ensuring that students come to class prepared. A suggestion is to test students’ knowledge at the beginning of class by using a poll or a quiz. Jensen, Kummer, and Godoy (2015) provide evidence to suggest that it is the active-learning strategies implemented alongside the flipped classroom approach that improve student performance.

- **Collaborative learning** is based on the use of social interactions as a means of knowledge building while respecting individual contributions to the final result (Roberts, 2004). It can be a coordinated attempt to analyse a problem where everyone is responsible for one aspect of the final solution (Judd, Kennedy, and Cropper, 2010). This approach supports the use of critical discussion, debates and group goals. Often collaborative groups are formed by two or more students who are interdependent. One of the benefits of collaborative group work is that students are exposed to and are able to reflect exposure to multiple perspectives, which may help in the construction of their own understanding (Swan, Shen, and Hiltz, 2006) Assessing individual students’ learning through this approach may be a challenge (Roberts, 2004), so the suggestion is to develop clear marking criteria to support the process for both the teacher and the student.

- **Peer instruction** is a classroom practice in which students work in teams to discuss challenging questions, and is considered a variation of collaborative learning. Originally introduced by Eric Mazur to help students start thinking like physicists, peer instruction is designed to support the development of deep understanding through discussions based on a key problem with no right or wrong answers (Simon and Cutts, 2012a). The ‘right’ answer is apparent once the students use the appropriate core concepts in their attempts to articulate their understanding of the problem and the solution to it (Simon and Cutts, 2012b). Peer instruction is argued to have a strong
influence on affective emotions towards the topic, may result in pride over individual contributions, social cohesion, and improved relations with the lecturer. The requirement to work in groups can increase the importance of preparation and attendance. Students explicitly report the development of reasoning skills (Simon, Esper, Porter, and Cutts, 2013).

The pedagogical approaches described above are only some of the most commonly cited in the literature and are among those promoted in the current study due to the empirical research that support their effectiveness. The following section now turns to framing how teachers may be supported to use these approaches in learning design.

### 3.3 Supporting the design of constructivist learning environments

#### 3.3.1 Learning Design

Learning design (LD) has developed as a field over the last 15 years (Agostinho, Lockyer, and Bennett, 2018). It’s aim is to “provide support and guidance for educators to develop, use and reuse pedagogical designs, many of which are built on [but not restricted to] social constructivist learning theory” (Dobozy and Cameron, 2018, p. i).

LD differentiates itself from instructional design mainly due to its focus on practicing educators. Instructional design is the “systematic and reflective process of translating principles of learning and instruction into plans for instructional materials, activities, information resources, and evaluation” (Smith and Ragan, 1999). On the other hand, LD is conceptualized as,

"a layer of abstraction above traditional pedagogical theories in that it is trying to develop a general descriptive framework that could describe many different types of teaching and
learning activities. Learning design does not put forward a theory about how learners learn, and hence how teachers should teach. There is no “should” in Learning Design as a descriptive framework, rather LD is a pedagogical meta model. Learning Design frameworks can describe a broad range of teaching and learning activities” (Dalziel et al., 2016, p. 9).

In the current study, learning designs are understood as a “representation of teaching and learning practice documented in some notational form so that it can serve as a model or template adaptable by a teacher to suit his/her context” (Agostinho, 2006, p. 3).

Initially, the field of LD was heavily focused on technological implementation and the development of learning design models. These models provided instructions and incorporated suggestions of elements to include for increased engagement in a technology supported learning environment. Some noteworthy models are Gagne’s nine events of instruction designed to support cognitive structures (Gagne, Briggs, and Wager, 1992); the four component instructional design (4C/ID) system focused on supporting high-level abilities (van Merriënboer et al., 2002); the attention, relevance, confidence and satisfaction (ARCS) model designed to promote motivation for learning (Chang and Chen, 2015; Francom and Reeves, 2010; Malik, 2014); Goodyear’s patterns based approach to educational design (P. Goodyear, 2004); and Willis’ R2D2 model which is based on constructivist interpretivist theory (Bonk and Zhang, 2006; Merkley, Duffelmeyer, Beed, Jensen, and Bobys, 2007). While there are many existing LD models, the current study will not focus on any of these models given that on the whole, they are quite specific and tend to take a prescriptive approach.

Dalziel et al. (2016) outline the Open University in the UK, The Australian University Teaching Council (AUTC), the Source Project and the Learning Activity Management System (LAMS) as foundational projects that collectively provide a comprehensive understanding of LD. Of these, the most relevant LD framework to the current study is the AUTC project. Given that the AUTC project provides flexible and useful LD
guidelines, tools and solutions for learning design representations suitable for both blended and fully online subjects, the approach can be easily aligned with a social constructivist approach. The AUTC project resulted in a repository of reusable learning designs, as well as a framework for evaluating them (Agostinho et al., 2002; Oliver, Harper, Hedberg, Wills, and Agostinho, 2002).

![Figure 3-1 Elements required in a learning design. Taken from (Agostinho, Oliver, Harper, Hedberg, & Wills, 2002)](image)

The AUTC project built on the work of Oliver (1999) who identified intended tasks, resources, and supports as critical elements to learning designs (Figure 3-1). Moreover, these critical elements can be graphically represented as reusable guidelines to support teachers’ implementation of learning sequences, also known as a learning design representation (Figure 3-2). As such, LD can provide a common language for teachers to describe and share best practice.
There is empirical evidence to suggest that the benefits of learning design representations include being readily understood and reused, foster design ideas or benchmarking and support technology integration competencies (Agostinho, Bennett, Lockyer, Jones, and Harper, 2013). As such, representations of learning designs provide a powerful focus for PD activities, given that they can support teachers’ “know-how”, as well as a discussion of the “know-why” behind a learning sequence. Learning designs also provide pedagogical and technological specifications that can support teachers’ enactment of best practice.

Oliver, Harper, Wills, Agostinho, and Hedberg (2013) established a framework to categorise learning designs. They introduced a typology which categorised learning designs into rule-based, incident-based, strategy-based, role-based. This typology is useful for PD programs, because it allows a PD facilitator to categorise teachers’
intended tasks, which assists in the identification of needs and possible solutions specific to the teacher’s curriculum. This typology is represented below (Table 3-1).

Table 3.1 A framework for learning design typology. Taken from (Oliver et al., 2013, p. 106)

<table>
<thead>
<tr>
<th>LD Focus</th>
<th>Description</th>
<th>Learning Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rule-based</td>
<td>The learning task requires learners to apply standard procedures and rules in the solution. For example, algorithmic approaches, the application of given procedures and rules.</td>
<td>A capacity to meaningfully and reflectively apply procedures and processes.</td>
</tr>
<tr>
<td>Incident-based</td>
<td>The learning activity is based on learners' exposure and participation to events or incidents of an authentic and real nature. The learning is based on activities that require learners to reflect and make decisions based on the actions and events.</td>
<td>Understanding procedures, roles and ability to apply the knowledge.</td>
</tr>
<tr>
<td>Strategy-based</td>
<td>Learning is based on tasks which require strategic planning and activity.</td>
<td>A capacity to apply knowledge in meaningful ways in real life settings.</td>
</tr>
<tr>
<td>Role-based</td>
<td>The learning is achieved through learners' participation as a player and participant in a setting which models a real-world application. Learners apply judgments and make decisions based on understandings of the setting in real-time scenarios.</td>
<td>An understanding of issues, processes, and interactions of multi-variable situations.</td>
</tr>
</tbody>
</table>

Based on the nature of each of these categories, Oliver et al. (2013) further considered the forms of tasks, supports, and learning resources that would be required in each learning setting. These are represented in Table 3-2.

Table 3.2 Characteristic elements of learning designs. Taken from (Oliver et al., 2002)

<table>
<thead>
<tr>
<th>LD focus</th>
<th>Learning Task</th>
<th>Learning resource</th>
<th>Learning supports</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rule-based</td>
<td>Closed tasks, logical and bounded tasks in authentic settings, the procedural sequence of manipulations, projects and inquiry-based forms</td>
<td>Case-based materials, authentic resources, multiple sources, algorithmic descriptions, and tutorials.</td>
<td>Collaborative learning, teacher as coach/guide, opportunities to articulate and reflect.</td>
</tr>
<tr>
<td>Incident-based</td>
<td>Story based tasks with disambiguate variables, case analysis tasks.</td>
<td>Incident/event descriptions and scenarios, case materials, theoretical underpinnings.</td>
<td>Collaborative learning, opportunities to articulate and reflect, teacher as coach/guide.</td>
</tr>
</tbody>
</table>
It seems clear that this framework can act as an incredibly useful guide in the creation of carefully planned learning tasks, resources and supports. The typology outlined above can also serve as a map to guide the evaluation of learning designs. This chapter now describes methods used to support teachers’ LD competencies.

### 3.3.2 Designing for learning

The day to day practice of teachers may inevitably involve designing teaching and learning activities as well as lesson planning. Beetham and Sharpe (2013) define Designing for Learning as “the process by which teachers can arrive at a plan, structure or designed artefact for a learning situation” (p. 8). It is a process that guides university teachers to create a learner workflow. Well-designed workflows can cater to the needs of individual learners. Stimulating and motivating environments can potentially sustain interest by providing the appropriate challenges, resources, and tools for learners to work beyond their comfort zones as they develop their knowledge and skills (Oliver et al., 2013). Goodyear and Carvalho (2013) suggest broad principles for Designing for Learning:

1. The main objective is to design good learning tasks. Tasks and subtasks are interconnected in a manner that makes sense together. And within that architecture what works needs to be seen as an accomplishment, the rest as opportunities for improvement.
2. The design must also take into account the social and physical setting. Within the architecture of the task, resources, interpersonal and social relations can interrelate and work in supportive ways.

3. The task needs to work fluently across all scale levels. If what matters is what the learner does, then the task is not what is most relevant. What matters is how the resources and tools support individuals to engage in an activity.

There is a wide range of work that suggests strategies to support the designing for learning process. Elliott and Lodge (2017) propose a series of steps to engage university teachers in design thinking. The strategy is to involve teachers in identifying a pedagogical problem within a context, gathering information to understand the limitations and constraints, brainstorming ideas, developing and testing the solutions, to finally evaluate the learning experience so it can be improved. In their view, the learning experience becomes a starting point for exploration. This approach can also include students as co-producers in the design process. Design thinking requires teachers to consider the aspirations, preferences, and resources that learners bring to the task to enhance accessibility and inclusion. This approach draws on networked learning, in which artefacts and technologies should be interconnected as a network that enables students to act and learn in their own right (Goodyear, 2008; Goodyear, 2004).

The notion of design thinking is relevant to the current study given that it informs the PD process by which to support teachers’ development of learning design competencies directly focused on their own curriculum.

3.3.3 Activity-centered design

It is argued that the quality of learning designs shape what students learn (Goodyear and Markauskaite, 2012). Activity-centered designs are concerned with guiding student learning actions. This approach is based on the premise that activity cannot be designed but rather that design can influence activity through the proposed task
and through the shaping of the physical and social contexts in which that activity is situated (Goodyear and Markauskaite, 2012; Muñoz-Cristóbal et al., 2018).

Activity-Centered Design does not address the macro level of designing an entire subject. Rather, it focuses on creating effective tasks that can be weaved into a coherent architecture that interrelates tasks while considering desired outcomes, subject matter, time, and gradual increases in complexity to keep interest through challenge. Goodyear and Markauskaite (2012) argue that in this approach tasks are resources and not specifications for action. Tasks need to allow for freedom, creative interpretation, customization, and contextuality. This also means that the inclusion of tools and resources need to support the activity and not the task. PD can support teachers to understand this process.

### 3.4 Learning design approach

The LD approach promoted in the current study takes insights from learning design, design thinking, activity-centered design and is strongly aligned with the concept of constructive alignment (*Figure 3.3*). Building on the work of Biggs (1996), constructive alignment recognizes that teaching is an interrelated sequence that involves the teacher, student, context, learning activities, assessments and resources focused on achieving desired outcomes. Every component in this sequence interacts and is aligned with each other. The strategy concerning each element is outlined below (*Figure 3.3*):
Learning outcomes: are clear learning goals and success criteria that describe what students can achieve in terms of skills, knowledge, attitudes, and values. Making students aware of the expected learning outcomes right from the start is critical to enhancing learning achievement. Learning objectives can also serve as success criteria to help students understand what the teacher will judge in their performance. Moreover, Beetham (2013) recognizes that learning goals are the basic building blocks of outcome-based design, as they serve to identify the change that is anticipated in the learner. Therefore, the first step in the design of a subject, task or assessment is to identify the desired goals to ensure a coherent interaction of elements through constructive alignment in the educational materials. The second step is to write out measurable outcomes to focus the evaluation. Objectives pave the way to an appropriate selection of pedagogical strategies, supports, and educational tools. They will also serve as the starting point of evaluation.

Pedagogical approach: In the current study, the task is the foundation for the integration of instructional strategies into the learning context and informs the
decisions, information, resources, and tools necessary to implement it. Beetham (2013) makes a distinction between the task which is predefined for learners by the teacher within the framework of the curriculum. A task is what can be planned, created, implemented and evaluated by the teacher. Activity, on the other hand, is defined as, "specific interaction of learner(s) with other(s) using specific tools and resources, oriented towards a specific outcome" (p. 35). Therefore, activities are engaged by learners in response to the demands of the task. As outlined in Figure 3-3, the PD process involves first helping the teacher to become aware of the pedagogical approach specifically aligned to the learning outcomes in their curriculum. Then the task is designed based on the implementation strategies outlined by the literature of that specific pedagogical method.

This approach also recognizes that artefacts may mediate learning. It isn't until the teacher has identified and written the desired learning outcomes and have selected the pedagogical approach to the task that they are suggested to think about integrating technology. This is to avoid a technocentric approach to LD. In fact, Beetham (2013) suggests a scaffolded approach to introducing technological tools. The specific suggestion is that learning how to use a technological tool should be the result of earlier activities. "No technologies should be introduced to the learning situation without consideration of learners’ confidence and competence in their use. The learning should also extend that competence" (p.43).

Assessment: In more traditional learning environments, assessments practices tend to focus on somewhat rigid demonstrations of knowledge recall. These approaches can be inadequate and superficial given the different dynamics presented by the online context. Assessment is defined as “...an ongoing process aimed at understanding and improving student learning. It involves making our expectations explicit and public; setting appropriate criteria and high standards for learning quality; systematically gathering, analysing, and interpreting evidence to determine how well performance matches those expectations and standards; and using the resulting information to document and explain and improve performance” (Swan et
The suggestion is to adopt an assessment strategy that is more constructivist and flexible to be able to consider a product, a performance, a solution, as possible demonstrations of knowledge acquisition. Collaborative and formative assessment are suggested as viable options.

Formative assessment is often thought of as “assessment for learning” given that its emphasis is on appraising learner’s progress in a manner that informs the subsequent flow of instruction (Spector et al., 2016). Both self-assessment and peer assessment are considered meaningful as they allow the student to monitor the quality of their own work, as well as obtain the knowledge and skills to be able to compare their work against high-quality work. Assessments that result from collaborative learning are another suggested strategy. This may involve students collaborating to resolve a problem, create a project, resolve a case study, do a class presentation, simulation, role play, or write an essay. A collaborative assessment strategy could involve small groups of students in creating, answering, and grading each other’s questions in an online exam (Swan et al., 2006).

_Evaluation:_ Evaluation is often overlooked even if it is considered an integral part of learning design. Evaluation immerses the teacher in a reflection process to find evidence of the effectiveness and impact of the pedagogical approaches he or she used for students’ learning. (Oliver and Conole, 1998). The focus in the current study is on both formative and summative evaluation of the learning experience. Formative evaluation focuses on the process of teaching and learning as it develops over time and hence requires much more frequent intervention (Knapper, 1980). According to Dick and Carey (1991), there are three characteristics that distinguish formative evaluation: it focuses on identifying strengths and weaknesses, it is iterative or cyclical, and judgments are made on actual performance. A focus of formative evaluation involves helping teachers identify the feedback opportunities on teaching performance found in daily student-teacher communications, in results from assessment tasks, and/or in requests for support.
Summative evaluation is the appraisal of the activity after the instructional event. It is usually more in-depth and has as a main objective of helping teachers determine if ongoing instruction is worth of being continued (Dick and Carey, 1991). There are many models to help determine instructional quality. Kirkpatrick's' four-level evaluation (Kirkpatrick & Kirkpatrick, 2006; Praslova, 2010) or integrative evaluation (Draper, Henderson, Brown and McAteer, 1996) are some of the most commonly used approaches.

3.5 Chapter summary

In this chapter, the focus was on the pedagogical and learning design approach that will be promoted through the PD program. While the list of pedagogical approaches was not exhaustive, these will inform ways to respond to teachers' curricular needs. Learning design provided an overview of the specific strategies for creating constructivist environments, as well as a methodology to support teachers' competencies. Chapter 4 will now focus on pedagogical beliefs, and TPACK considered relevant to PD support for technology integration practices.
This chapter explores the role of teacher beliefs and technological, pedagogical and content knowledge (TPACK) in teaching practice. The chapter begins by presenting an overview of beliefs as a general construct and introduces pedagogical, epistemological, value and self-efficacy beliefs. Models to conceptualize beliefs will be explored prior to discussing the relationship between beliefs and practice, educational technology and professional development. The focus then shifts to the origins of the TPACK framework, the characteristics that make it a meaningful technology integration framework, as well as the most recent efforts to advance its theoretical development. The chapter also provides an overview of how TPACK can inform the design of effective PD. The discussion at the end of the chapter explores the difference between beliefs and knowledge and how each of these constructs influence teaching practice.

4.1 What is the relevance of teacher beliefs?

Research on the technology integration practices of teachers in higher education is extensive and varied. There are published accounts of PD approaches to support technology integration (Ertmer et al., 2012), as well as studies on how university teachers design learning experiences (Bennett et al., 2011). However, as Rienties, Brouwer, and Lygo-Baker (2013) point out, there is little research on the impact of PD approaches that affect visible changes to actual teaching practice,

“research has shown that providing effective training to academics so that they learn how to effectively design learning opportunities, in particular through the incorporation of ICT is not straightforward. In a meta review of 36 studies in higher education, Stes et. al. (2010) conclude that only three (out of 31 studies) measured the impact of professional development on teachers’ behavior using a pre and post-test method. So the challenge is not only designing effective, pedagogically sound professional development but also demonstrating the impact that this has had.” (p. 123).

What is more, a recurrent criticism of PD for technology integration is that too often teachers are only provided support with technology specific skills (Kim et al., 2013). This is considered inadequate in influencing visible changes in technology
integration practices (Lawless and Pellegrino, 2007). “Achieving the goal of meaningful technology integration does not depend solely on technology-related factors. Ultimately teachers’ pedagogical beliefs play a key role in their pedagogical decisions regarding whether and how to integrate technology within their classroom practices” (Tondeur, van Braak, Ertmer, and Ottenbreit-Leftwich, 2017).

Evidence from the literature suggests that teacher beliefs influence technology integration (Liu, 2011b). This is because teacher beliefs can filter and direct behaviour and thought processes (Pajares, 1992; Tondeur et al., 2017), as well as provide a basis for motivational orientations (Bender, Schaper, Caspersen, Margaritis, and Hubwieser, 2016). Finding ways to make beliefs explicit can facilitate sustained PD outcomes in the long term (Albion et al., 2015).

When it comes to the relevance of beliefs regarding technology integration practices, there is evidence to suggest that there are two types of barriers which are critical considerations in designing effective PD: first order barriers are extrinsic to educators and may include access to technological resources, time and support (Bai and Ertmer, 2008; P. Ertmer, 1999; P. A. Ertmer, 2005). Second order barriers are elements internal to the teacher and include “teacher’s confidence, beliefs about how students learn, as well as the perceived value of technology to the teaching/learning process” (P. A. Ertmer et al., 2012, p. 423). Teacher beliefs conform to the second order barrier and are a central focus of this study.

4.2 What are teacher beliefs?

Studying teacher beliefs is a complex task given that often individuals are not aware of what they believe. Consequently, published empirical studies on this topic are relatively scarce. Moreover, in the literature that does exist, teacher beliefs are an ill-defined construct due to “definitional problems, poor conceptualizations, and differing understanding of beliefs and belief structures” (Ertmer, 2005, p. 28).
The terms used to describe teacher beliefs are not consistent and have been referred to as principles of practice, personal epistemologies, perspectives, or practical knowledge (Kagan, 1992). Teacher beliefs have also been termed as preferred ways of teaching (Liu, 2011a), teaching orientations (Kember, 1997) or teacher cognition (Ertmer, 2005). Others refer to teacher beliefs as expectations, confidence in abilities to teach or use technology, and value beliefs (Kim et al., 2013). Pajares (1992) suggests that the confusion may be due to a blurring of the distinction between beliefs and knowledge (this distinction is fully explored in the discussion at the end of this chapter).

Belief systems start developing from birth. As we grow older, what we think we believe guides our interactions with the world and informs the way we deal with information and make decisions (Bender, Schaper, Caspersen, Margaritis, and Hubwieser, 2016). Our beliefs serve as unconscious filtering mechanisms that help us to survive, to affirm our identities and our connection to others (Ottenbreit-Leftwich, Glazewski, Newby, and Ertmer, 2010a). Our belief systems are based on a lifetime collection of experiences.

Belief systems “consist of an eclectic mix of rules of thumb, generalizations, opinions, values, and expectations grouped in a more or less structured way.” (Ertmer and Ottenbreit-Leftwich, 2010, p. 262) Beliefs take the form of suppositions, commitments, and ideologies (Ertmer, 2005). Interestingly, when an individual is asked to explain or expand on their beliefs, that individual may struggle. Often it is in occasions of confusion, doubt, or when they are directly questioned, that individuals will likely take time to reflect on what they believe.

Belief systems vary in strength and type. Ertmer (2005) affirms that stronger beliefs are those that are more central to an individuals’ identity, are shaped earlier in life and are used to process subsequent experiences. Therefore, the strength or “centrality” of beliefs relate to their connectedness, and stronger beliefs may be harder to change.
For the purpose of the current study, the literature review will focus on presenting an in-depth discussion of pedagogical beliefs, epistemological beliefs, value beliefs, and self-efficacy beliefs because of their potential influence on teaching practice.

4.2.1 Pedagogical beliefs

Pedagogical beliefs are typically associated with conceptions of teaching, which are proposed to be predictors of technology integration in the classroom (Liu, 2011a). Teachers’ pedagogical beliefs include implicit suppositions about students, learning, resources and curriculum content (Ertmer, 2005; Kagan, 1992; Yuan, 2017). Pedagogical beliefs are perceived as a combination of “self-efficacy, beliefs about the value of technology, and beliefs about teaching and learning with technology” (Kim et al., 2013, p. 70). As belief systems are interrelated, pedagogical beliefs result directly from experience (Ertmer, 2005; Pajares, 1992). In fact, the most important source of pedagogical beliefs is the educator’s own experiences with schooling and instruction (Bai and Ertmer, 2008). Their strength makes pedagogical beliefs resistant to change due to the time it takes to develop them (Kim et al., 2013). It is not uncommon to find an individual who has certain deep-seated inclinations or opinions towards a particular instructional strategy or technological tool as a consequence of an early experience as a student or experience with a previous teacher.

Pedagogical beliefs rely on episodic memory, where information is drawn from personal, vicarious or social influences (Ottenbreit-Leftwich et al., 2010a; Pajares, 1992). Particularly vivid or unique events can inform an individual’s perception of subsequent events. In this way, beliefs act as a lens or filter that allow individuals to process, evaluate or interpret new, incoming information (Bender, Schaper, Caspersen, Margaritis, and Hubwieser, 2016). Moreover, when an event triggers conflicting beliefs, the more relevant belief may override the other (Bai and Ertmer, 2008).
The particularity of pedagogical beliefs is that they tend to be unbounded, that is “extended to apply to phenomena that may be unrelated to the context in which they were formed” (Ertmer, 2005, p. 30). As such, previous negative experiences with computers in an educational context are likely to shape future uses of technology.

Another important aspect is that pedagogical beliefs are idiosyncratic; meaning beliefs are inherently personal and do not require group consensus (Ertmer, 2005; Pajares, 1992). Two teachers may possess the same knowledge but may hold different beliefs about the uses of technology. They may also adopt the same instructional strategy for different reasons (Ernest, 1989). So, beliefs should not be generalized. In fact, there is evidence to suggest that even within an individual, belief systems are not consistent with each other (Ertmer, 2005; Kim et al., 2013).

Pedagogical beliefs are also tacit, which means that they are often unconscious assumptions about the teaching-learning process, resources and students (Ertmer, 2005; Ottenbreit-Leftwich et al., 2010).

### 4.2.2 Epistemological beliefs

Epistemological beliefs refer to the beliefs “one holds regarding the structure, source, and certainty of knowledge, as well as the source of control of the knowledge acquisition” (Arredondo and Rucinski, 1996b, p. 4). Epistemological beliefs tend to influence the choices teachers make about teaching approaches given that they consider the nature and process of knowing. As such, epistemological beliefs are important to the current study because higher education institutions are subdivided into more or less independent faculties, schools or departments that may have different degrees of control over curricula, varying organizational cultures, and possibly even advocate different teaching approaches deemed more suitable to their discipline.
4.2.3 Self-Efficacy beliefs

In relation to teaching and learning, self-efficacy is the teacher’s “perception of the extent to which their own teaching has the potential to invoke learning in their students” (Hatva and Goodyear, 2002, p. 349). It refers to the “generalized expectancy” teachers have on their ability to influence students and perform professional tasks (Kagan, 1992, p. 67). If a teacher is able to identify a link between an action and a successful outcome, that teacher’s confidence in their ability to perform such actions means that they are likely to pursue it (Galvão de Barba, 2017). According to Bandura (1993) self-efficacy beliefs are linked to the mechanism of human agency because they represent an individual’s confidence in their capacity to control their performance and lives. Low control beliefs lead an individual to perceive that an outcome is independent of their actions, and have been found to result in disengagement from activities, depression, apathy towards learning and helplessness (Galvão de Barba, 2017). As such, self-efficacy is influential over the way people feel, think, act and motivate themselves.

It is argued that thoughts often determine actions, making self-efficacy beliefs relevant to the self-regulation of motivation (Galvão de Barba, 2017). Bandura (1993) argues that self-efficacy beliefs “determine the goals people set for themselves, how much effort they expend, how long they persevere in the face of difficulties, and their resilience to failures. When faced with obstacles and failures, people who harbor self-doubts give up quickly, [while] those who have strong beliefs in their capabilities exert greater effort when they fail to master the challenge” (p. 131). Because of their nature, self-efficacy beliefs can influence teaching practice and uses of technology, and will be further discussed in detail later in this chapter.

4.2.4 Value beliefs

Values are defined as, “constructs of worth, being espoused in language as goals, ideals and preferences or extracted from actions through processes of interpretative
sense making. Values are expressions of intentionality and show a close but not closed interrelationship with action” (Aadland, 2010, p. 463) Similar to self-efficacy beliefs, value beliefs are related to achievement, choice and persistence. Value beliefs are relevant to the current study given their influence on pedagogical decisions and perceptions of the value of PD.

Galvão de Barba (2017) outlines four main components of value beliefs:

1. **Attainment value** relates to the relevance an individual assign to good performance, and how this performance expresses or confirms aspects of their own self-identity.
2. **Intrinsic value or interest** refers to the enjoyment that derives from an action.
3. **Utility value** relates to the usefulness of a course, tool, activity or support to their lives.
4. **Cost** relates to the amount of effort or resources related to engaging in an activity.

### 4.3 Conceptualizing beliefs

The tacit and idiosyncratic nature of beliefs makes it challenging to understand them. This section will introduce available models used to conceptualize pedagogical and epistemological beliefs.

Pedagogical beliefs are typically conceptualized in the literature as a continuum of teaching orientations that oscillate between teacher-centred approaches, which imply a focus on knowledge transmission, and student-centred approaches which tend to focus on learning facilitation (Mostert and Quinn, 2009; Norton, Richardson, Hartley, Newstead, and Mayes, 2005; Tondeur et al., 2017).

Teacher-centred approaches are more closely aligned to traditional teaching and assessment methods, and are typically associated with behaviorism (Liu, 2011; Mostert and Quinn, 2009). In this approach, the teacher is often perceived as an
expert authority, while students are seen as passive actors in a highly structured environment (Tondeur et al., 2017). On the other hand, student-centred approaches tend to emphasize student needs, interests and responsibility for their learning and are typically associated with constructivism (Mostert and Quinn, 2009; Norton et al., 2005). Student-centred approaches are focused on knowledge construction and the set-up of dynamic, collaborative learning environments where students can co-create their own knowledge with the educator as a guide (Liu, 2011a; Tondeur et al., 2017). Student-centred instruction is directed towards facilitating authentic, 'real world' experiences, active learning, and includes a tendency to use educational technology to engage students (Ottenbreit-Leftwich, Glazewski, Newby, and Ertmer, 2010).

In the current study, teacher-centred and student-centred are understood as a continuum of teaching conceptions which has both practical and conceptual implications for practice. This continuum allows behavioural aspects of teaching practice to be classified, and provides insights into the thinking processes and pedagogical beliefs of educators. It is important to note that this framework should not be perceived as polarized opposites, because in the classroom, actions and decisions are neither black or white, nor either/or scenarios. This continuum allows for transitional areas. For example, a teacher may navigate a learning event taking a teacher-centred or student-centred approach depending on the need. The conceptions of teaching in this continuum have been further elaborated by Samuelowicz and Bain (2001) (Figure 4-1) and Kember (1997) (Figure 4-2).
Both of these frameworks are outlined here due to the breadth, depth and simplicity in the definition of each of the stages in the continuum. However, Kember’s (1997) work includes practical, and detailed descriptions of each of the stages in the continuum, including the transitional stages. The descriptions of each of the stages in Kember’s framework are outlined in Table 4-1 below.
Table 4.1 Dimensions used to delimit conceptions of teaching. Taken from (Kember, 1997, p. 262)

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Imparting information</th>
<th>Transmitting structured knowledge</th>
<th>Teacher–student interaction</th>
<th>Facilitating understanding</th>
<th>Conceptual change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher</td>
<td>presenter</td>
<td>presenter</td>
<td>presenter and tutor</td>
<td>facilitator</td>
<td>change agent/developer</td>
</tr>
<tr>
<td>Teaching</td>
<td>transfer of information</td>
<td>transfer of well structured information</td>
<td>interactive process</td>
<td>process of helping students to learn</td>
<td>development of person and conceptions</td>
</tr>
<tr>
<td>Student</td>
<td>passive recipient</td>
<td>recipient</td>
<td>participant</td>
<td>lecturer responsible for students’ learning</td>
<td>lecturer responsible for student development</td>
</tr>
<tr>
<td>Content</td>
<td>defined by curriculum</td>
<td>lecturer needs to order and structure material</td>
<td>defined by teacher</td>
<td>constructed by students within teacher’s framework</td>
<td>constructed by students but conceptions can be changed</td>
</tr>
<tr>
<td>Knowledge</td>
<td>possessed by lecturer</td>
<td>possessed by lecturer</td>
<td>discovered by students but within lecturer’s framework</td>
<td>constructed by students</td>
<td>socially constructed</td>
</tr>
</tbody>
</table>

Understanding the transitional stages of this continuum is essential to being able to recognize more subtle changes in teaching practice through longitudinal programs. As Samuelowicz and Bain (2001) assert, “An intermediate orientation, facilitating learning, suggests that academics expressing such an orientation [are] in transition from a transmissive to a facilitative perspective and that interaction between student and teacher [is] the active agent in the change process” (pp. 300-301). It is important to consider that influencing a transition in pedagogical beliefs may require a long time due to the centrality of these beliefs. In fact, Tondeur et al., (2017) claim that it may take as long as three years for a visible shift in practice to occur.

Evaluating the specific nature of the student versus teacher-centred continuum also enables the diagnosis of participants’ pedagogical beliefs on the continuum, in a PD program (for more on the assessment instrument used in the current study, see chapter 6). This diagnostic process allows PD strategies to be tailored to respond to
participants’ specific needs, as well as to track participants’ progress over the course of a PD program.

In regards to epistemological beliefs, a model for understanding them has been outlined by Schommer (1990)’s. This model is conformed by five dimensions described as follows:

- **The structure of knowledge**: knowledge can range from isolated bits to integrated concepts. Knowledge is viewed as being built upon a strong foundation, or it may be an interconnected web of facts or assumptions about a concept.

- **The stability of knowledge**: may range from knowledge that is certain and unchangeable to knowledge that is continually evolving. An example of this conception of knowledge is the difference between the biblical story of genesis, which contrast greatly from the concept of evolution as a constant adaptation of species evolving to better survive in their environment.

- **The source of knowledge**: may be imposed by authority, or may derive from reason or evidence. In the example provided about the story of genesis, knowledge is developed in the individual through the teachings of a priest or the bible, which contrasts with knowledge on evolution deriving from scientific studies.

- **The speed of learning**: This assumption may range from learning quickly or not at all, to learning as a gradual acquisition of knowledge.

- **The ability to learn**: which may range from fixed at birth to learning as improvable.

These five dimensions of epistemological beliefs help clarify the broad array of perceptions of the process of knowledge acquisition, and allow individuals to be divided into naïve or sophisticated learners. The distinction is as follows:

“Naïve learners believe that knowledge is certain and unchanged, that knowledge is mainly transferred by authority and expert figures, that the ability for a person is fixed and inborn, and that learning effort does not change the results. In contrast, sophisticated learners
believe that knowledge is continuously evolving and self-constructed, that authority can be questioned or criticized, that the ability of a person is not inborn and fixed, and that knowledge acquisition is a process that requires effort” (Lee, Zhang, Song, and Huang, 2013, p. 121).

The naïve or sophisticated epistemological beliefs of teachers can influence the type of learning environment the teacher will create, and as a result may have an indirect influence on student learning. These influences are described in the following sections.

4.4 What is the relationship between beliefs and practice?

When it comes to pedagogical beliefs, there is evidence of a relationship between student-centred approaches and deep learning, and between teacher-centred approaches and surface approaches to learning. For example, a qualitative study by Trigwell, Prosser, and Waterhouse (1999) found that in learning environments in which teachers tend to focus on knowledge transmission, students report surface approaches to learning. The same study found that teachers that adopt approaches that aim to change students’ conceptions are reported to have a significant influence on deeper approaches to learning.

Rienties et al. (2013) and Rienties, Brouwer, Lygo-Baker, and Dekke (2014) also conducted a studies which focused on understanding the teaching practice of business lecturers in higher education. The researchers report that academics with more student-centred orientations are more likely to design tasks based on active learning methods, which are argued to facilitate a deep, rather than a surface approach to learning by students. On the other hand, teachers with a more teacher-centred approach are more likely to design tasks in which they are the expert authority and thus the most active participant; this orientation was observed to be less effective in motivating student achievement. Liu (2011) confirms this notion after the implementation of a PD program, “only learner-centred belief had significant effects on external expectation and student achievement [...] Teachers who held learner-centred beliefs considered student achievement more than did
teachers with teacher-centred belief” (p.1019-1020). It should be noted, however, that teachers have been observed to swing back and forth on the continuum between student and teacher-centred approaches.

There is also evidence of a relationship between epistemological beliefs and teaching practice. Arredondo and Rucinski (1996b) and Lee et al. (2013) report that teachers who believe that abilities are innate and fixed are unlikely to use student-centred conceptions. In contrast, criticizing authority and stronger beliefs in learning effort/process may predict constructivist conceptions. In addition, Arredondo and Rucinski (1996a) argue that teachers who believe in the changing nature of knowledge are likely to implement artful instruction that supports the development of active, independent learners. But if the same teachers favour lecturing and multiple-choice assessments as main instructional strategies, they may implicitly communicate that knowledge is certain and imposed by authority. Moreover, teachers that strongly believe that acquiring knowledge is simple are likely to subdivide tasks into elements that are taught and practiced in isolation, which tends to move away from authentic assessment.

Teacher’s self-efficacy is also strongly related to classroom behaviours and can influence the type of learning environment teachers create and the learning approaches of students (Bandura, 1993; Bender, Schaper, Caspersen, Margaritis, and Hubwieser, 2016). Kagan (1992) argues that self-efficacy helps determine behaviours such as a tendency to praise rather than criticize during feedback, to persevere with low achieving or at-risk students, to be task oriented, enthusiastic and/or accepting of student opinion, and to work on improving reading, mathematical or problem-solving abilities in students. Moreover, Bandura (1993) argues that teachers who are confident in their teaching abilities create more mastery experiences for students, support student development of intrinsic interests and self-directed learning. On the other hand, teachers with low self-efficacy devote more time to pastimes and lean towards authoritative orientations that rely on external incentives or sanctions to get students to study.
In an educational context, value beliefs relate to the reasons why a teacher believe an academic task, tool or support is important to the learning process (Ertmer and Ottenbreit-Leftwich, 2010). When faced with an innovative pedagogical strategy or technological tool, teachers will make judgements about whether a particular strategy or tool is important to their goals. If they judge a tool to be valuable, they are more likely to use it (Ottenbreit-Leftwich et al., 2010).

4.5 What is the relationship between beliefs and technology use?

Pedagogical beliefs have direct influences on the use of educational technology to support teaching practice. The reason is that pedagogical beliefs can inform professional decisions about teaching and learning, and serve as indicators of certain in-class behaviours (Bender, Schaper, Caspersen, Margaritis, and Hubwieser, 2016; Kagan, 1992; Kim et al., 2013). What educators believe or think may determine what they will do in the classroom. For example, Liu (2011) observed that teachers with more constructivist or student-centred beliefs use technology often and tend to engage students in more technology-enhanced, student-centred learning activities including collecting, analysing, organizing, presenting information, etc. This approach is known as high-level use of technology and there is evidence to suggest that it supports deep learning and higher order thinking (Albion et al., 2015; Fullan and Langworthy 2014; Kim et al., 2013; Liu, 2011; Samuelowicz and Bain, 2001). The concept of using the computer as a tool to help students learn by thinking (mind tool) is representative of a high-level use of technology given that it supports meaning generation by students (Kim et al., 2013). Research projects, data analysis, problem solving activities, self-assessment of work, critical online discussion, using mind mapping tools, or promoting peer feedback in digital story telling activities are some examples of high level uses.

On the other hand, educators with more teacher-centred beliefs tend to use less technology, or opt for low-level uses which emphasize skills acquisition, or support
the delivery of material (Bai and Ertmer, 2008; Ottenbreit-Leftwich et al., 2010; Tondeur et al., 2017). Some low-level uses of technology may include using PowerPoints as the primary aid to transmit knowledge, assigning homework practice on a computer, sending email announcements or using the LMS as a repository of materials for students to review. In fact, Ertmer and Ottenbreit-Leftwich (2010) indicate that the primary pedagogical uses of technology include: writing assignments, conducting online research for preparation of delivery materials, and checking grades online.

Low-level uses of technology by teachers are the most common, but technology use to facilitate engagement and higher order level thinking is the recommended best practice (Ertmer and Ottenbreit-Leftwich, 2010). The reality is teachers’ uses of technology are not always geared towards facilitating meaningful student outcomes and this can have a considerable impact on student learning (Albion et al., 2015; Ertmer and Ottenbreit-Leftwich, 2010).

Epistemological beliefs can also determine the decisions teachers make when teaching with technology based on specific beliefs about knowledge construction in their own discipline. Kim et al. (2013) argue that the more sophisticated, constructivist approaches are conducive to a more “seamless use of technology” (p.82) given that the emphasis of the teacher’s practice is more likely to remain on student learning rather than on the technology.

Self-efficacy beliefs are considered to be a crucial barrier to technology integration, and are argued to be more important than skills and knowledge (Ertmer and Ottenbreit-Leftwich, 2010; Rienties et al., 2014). Ertmer (2005) highlights the importance of building teachers’ self-efficacy by supporting them to have successful experiences with small changes before attempting large innovations in their curriculum. Beetham (2013) urges learning designers to consider the learner’s confidence and competences before introducing any technological tools, adding that learning activities should enable individuals to extend their technological
competences progressively. Moreover, Ertmer and Ottenbreit-Leftwich (2010) also analysed the impact of knowledge, confidence, beliefs and culture on teaching practice. They found that a predictor of technology use is confidence. Responses collected through a survey indicated that a large number of technology using teachers rate “themselves as being highly confident in their use of educational technology compared to being highly skilled” (p. 261).

4.6 The relevance of beliefs to professional development

In relation to PD programs, pedagogical beliefs can act as filters of suggested strategies before they are assimilated into new knowledge structures (Ertmer and Ottenbreit-Leftwich, 2010). Teachers may be motivated and predisposed to learn new methods but if a method does not align with their beliefs, it is unlikely teachers will use their new knowledge (Ertmer, 2005). Lack of self-awareness about their own teaching practice will likely become an obstacle to PD outcomes. Consequently, Ertmer and Ottenbreit-Leftwich (2010) advocate for PD initiatives that make explicit pedagogical beliefs, and are situated within the context of teachers own curricular needs, to increase the likelihood of change. A noteworthy consideration is that cognitive dissonance can motivate change in beliefs (specific strategies to influence beliefs were explored in detailed in chapter 2). Cognitive dissonance may be understood as the mismatch between beliefs and behaviours in a specific context (Sweller, 2010; Sweller, Ayres, and Kalyuga, 2011). In other words, when teachers are challenged by a situation in which their actions are no longer effective, nor aligned to their beliefs, this triggers confusion. Ambiguity and uncertainty can motivate a lecturer to ask for help to take control of their environment.

Value beliefs present several implications for PD. The first one being that if PD efforts are focused on technology itself without any consideration of the participant’s curriculum, teachers are unlikely to incorporate such digital tools into their practice. Ertmer and Ottenbreit-Leftwich (2010) affirm that “the more content specific the example, the more likely the teacher will see value and learn it” (p.263).
Creating awareness of value can also influence a teacher’s decision to implement any suggested innovations from a PD intervention. For instance, clarifying the utility value of a specific tool may facilitate its adoption. At the same time, addressing the benefits of a strategy or tool to the learning process, may help override concerns over cost. In higher education, cost is commonly related to the commodity of time, and is often found to be an obstacle to technology integration practices given that academics are often time-poor.

The second implication of value beliefs for PD is the influence of value judgement on attitudes, which can provide insights into a person’s decision making. “Attitudes and beliefs are a subset of a group of constructs that name, define and describe the structure and content of mental states that are thought to drive a person’s actions” (Bai and Ertmer, p. 95). The link between value beliefs and attitudes is that they are both related to behaviours, actions and intentions, and so they are both likely predictors of technology use. In light of these considerations, it seems important to design PD environments conducive to identifying and assigning value. Usually, working with individuals on making the learning process more effective and efficient to achieving learning outcomes is likely to be a good starting point. Beyond that, the suggestion is to infuse positive attitudes by supporting teachers to have successful technology integration experiences in the classroom (Bai and Ertmer, 2008). To achieve this, ongoing or just-in-time support is paramount.

So far, the focus has been on providing a baseline understanding of the role of belief systems in technology integration practices. This chapter also highlighted the relevance of creating awareness in teachers about the nature of their beliefs and the influence those beliefs may have on their pedagogical decisions. To continue to build an understanding of more comprehensive PD approaches, this chapter will now explore the Technological, Pedagogical and Content Knowledge (TPACK) framework, which is considered to be a pragmatic and meaningful way to conceptualize PD approaches for technology integration.
4.7 Technological Pedagogical Content Knowledge (TPACK) framework

TPACK is a widely used framework to conceptualize and investigate teacher knowledge. It is also often used to guide the design of PD efforts to support technology integration practices (Dysart and Weckerle, 2015; Koehler and Mishra, 2009).

4.7.1 The origins of TPACK

Teaching is a complex activity that requires many kinds of specialized knowledge and abilities (Koehler and Mishra, 2009). Quality teaching involves the ability to motive and actively engage students in the construction of their own knowledge through learning experiences; guide and assess students’ performance; know how and when to provide effective feedback; and mediate the complexities of an ill-defined environment (Duarte, 2013). Good teaching in today’s world may also involve taking advantage of the benefits of Information and Communication Technologies (ICT) to facilitate learning experiences (Fullan and Langworthy, 2014). All these factors lead to the following question: how do we equip university educators with the appropriate knowledge and skills to be successful in their roles?

Shulman (1987) began tackling this question with the development of the Pedagogical Content (PCK) framework. In his seminal work, he stressed that PCK is a body of knowledge that is distinctive to teaching and differentiates a subject matter expert from an expert teacher. Represented in Figure 4-3, PCK is the interrelation between content and pedagogy (Shulman, 1986). It involves an understanding of the methods of teaching and assessment, how learning occurs and how to facilitate it and the methods to organize and represent content effectively (Jones and Moreland, 2005). More specifically, PCK encapsulates knowledge of how to teach a particular subject and make it comprehensible to others. This may include “the most useful representation of ideas, the most powerful analogies, illustrations, examples, explanations and demonstrations” (Mishra and Koehler, 2006, p. 1023). PCK evolves with experience and classroom practice through a process of
integrating different resources of knowledge. PD programs that take into consideration the elements of PCK should provide a basis for teaching staff to continually enhance their capabilities by reflecting and learning from their own experience.

Since 1987, PCK has been researched and critiqued by the academic community. With the rise of educational technology, Niess (2005) proposed the term TPCK in relation to technology-enhanced PCK (Angeli, Valanides, and Christodoulou, 2016). However, Valanides and Angel (2005) argued that ICT should not be viewed as a separate entity but used as a tool with intentionality; therefore they suggested incorporating ICT knowledge into Shulman’s framework. The notion of PCK as presented by Valanides and Angel (2005) is represented in Figure 4-4:

![Figure 4-4 Components of PCK-ICT. Taken from (Valanides and Angel, 2005, p. 85)](image-url)
The following year, Mishra and Koehler (2006) introduced the Technological, Pedagogical and Content Knowledge (TPACK) framework as a result of five years of experience working with PD programs for K-12 teachers to improve their uses of technology. Due to its comprehensiveness and parsimony, TPACK has been widely researched and used as a lens to design, implement and evaluate PD programs for teachers around the world (Cox and Graham, 2009; Graham, 2011). The framework is based on Shulman’s PCK but builds upon this by advocating a holistic approach to technology integration (Figure 4-5). TPACK is based on the premise that effective integration of educational technology requires a dynamic interrelation of content, pedagogy, and technology situated in unique contexts (Campbell et al., 2015; Schmidt et al., 2009). The interactions between each of the constructs result in seven knowledge areas with direct implications for teaching practice. At the centre, TPACK is epitomised in exemplary teachers that use high-level educational technology as an integral part of their teaching practice.

![Figure 4-5 Interrelation of elements in TPACK. Taken from (Koehler & Mishra, 2009)](image)

### 4.7.2 What is TPACK?

Mishra and Koehler (2006) recognize the flexibility needed to respond to teachers’ local contingencies and needs. Their framework establishes that each knowledge area cannot be separate from one another and that their subtle interaction
represents the complexities and messiness of any teaching environment in which educational technology is used. In practical terms, TPACK can be used to guide educators to identify a topic in their curriculum; to transform that content into tasks and assessments to engage students; and to facilitate that content through technological means to allow students to process, manipulate and create their own interpretations of the content in ways otherwise impossible without digital tools. The value of TPACK comes from the integrative approach it affords which is applicable to a diversity of disciplines and contexts. Such interrelations result in seven knowledge components (Table 4-2). With each of the components adding detail and complexity to the framework.

Table 4.2 Seven knowledge components of TPACK

<table>
<thead>
<tr>
<th>Knowledge Component</th>
<th>Description</th>
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<tbody>
<tr>
<td>Content Knowledge (CK)</td>
<td>Knowledge about the subject matter to be learned or taught (Koehler and Mishra, 2009)</td>
</tr>
<tr>
<td>Pedagogical Knowledge (PK)</td>
<td>Knowledge about the processes and practices of teaching and learning (Baran, Chuang, and Thompson, 2011)</td>
</tr>
<tr>
<td>Technological Knowledge (TK)</td>
<td>Knowledge of how to use emerging technologies (Cox and Graham, 2009)</td>
</tr>
<tr>
<td>Pedagogical Content Knowledge (PCK)</td>
<td>Knowledge of how to teach a particular content-based material (Harris and Hofer, 2009)</td>
</tr>
<tr>
<td>Technological Pedagogical Knowledge (TPK)</td>
<td>How to use particular technologies when teaching (Harris and Hofer, 2009)</td>
</tr>
<tr>
<td>Technological Content Knowledge (TCK)</td>
<td>Technologically represented content knowledge without pedagogical consideration (Chai, Ling Koh, and Tsai, 2016)</td>
</tr>
<tr>
<td>Technological Pedagogical Content Knowledge (TPACK)</td>
<td>Intuitive understanding of the complex interplay between the three basic components of knowledge (Baran, 2016)</td>
</tr>
</tbody>
</table>

The ability to effectively implement the intersection of these knowledge components (TPACK) is also called fit and it is considered a legitimate measure of TPACK in action (Archambault, 2016; Harris, Grandgenett, and Hofer, 2010). Fit describes an effective consideration and alignment of the curriculum, pedagogical strategies, and digital or non-digital technologies (Archambault, 2016). Being able to distinguish fit is essential to measure and explore how teachers integrate technology in a way that is content driven, is focused on student needs, and leverages the affordances of the technology to support the curriculum.
After using TPACK to study the work of design teams throughout the development of an online unit, Mishra and Koehler (2006) found that the framework has prescriptive, applicative and inferential uses. Its prescriptive nature helps to identify the characteristics of teacher knowledge and provides the language to discuss the connections within those knowledge areas. TPACK is also applicative, guiding the development of better learning environments supported by integrated, design-based approaches. It is also inferential, providing the scope to assess the mechanisms involved in effective PD programs and make predictions about teachers’ use of technology in their own context.

Other academics have reported positive findings after using the TPACK framework in their research. For instance, Baran et al. (2011) found that the TPACK framework is a useful planning tool to support professional development initiatives with academic staff. Graham (2011) found TPACK to be a useful framework to help teachers articulate and investigate their own knowledge. Herring et al. (2016) used TPACK as a guideline to design a PD model specifically for higher education, while Harris (2016) has reported a wide range of PD approaches used to support the technology integration practices of teachers.

Since this framework was introduced, however, the research community has also reported several limitations when dealing with the complexities of TPACK in action. The first limitation is concerned with the lack of clarity in the definition of each component, which in turn creates confusion about the specific activities and methods to develop such knowledge. Archambault and Barnett (2010) explored how this may be due to the origins of the framework. The main criticism of Shulman’s PCK framework is the perception that pedagogy is inherent in the act of teaching subject matter, and that “explanations of content are inherently pedagogical in nature” (p.1657). This raised issues with the validity of the framework given the difficulty in defining the boundaries between each of the knowledge components. Such claims motivated Archambault and Barnett (2010) to
conduct a nationwide survey in the U.S. in which experienced teachers were requested to differentiate components in the TPACK framework based on statements. Respondents reported that the only components to exist in practice were PCK; technological-curricular content knowledge and TK. Therefore, the authors concluded that “the highly accepted seven mutually exclusive domains of the TPACK theory may not exist in practice” (p.1658). According to their conclusions, the only clear definition is that of TK.

A year later, Graham (2011), published an analysis of TPACK using Whetten’s (1989) building blocks for theory development. In his analysis, he challenges the "weakness inaccurate knowledge categorization and [...] a lack of precision in the framework" (p.1957). He concludes that the framework is "limited in its ability to assist researchers in predicting outcomes or revealing new knowledge" (p.1959). In his conclusion, however, he also supports the notion that TPACK provides guidance to approach PD for technology integration, but calls on the research community to engage in robust theoretical development needed to solidify TPACK as a valid framework.

To date, the TPACK framework is considered “a young research field that is still searching for a generally accepted and solid theoretical conceptualization” (Angeli et al., 2016). However, because of the attention it has received, the research community has invested considerable efforts in clarifying the definitions of each knowledge component. Table 4-3 consolidates the literature on TPACK outlining the clear, detailed definitions and linking each knowledge component to concrete actions, to help identify them in practice.
<table>
<thead>
<tr>
<th>Knowledge components</th>
<th>Definition (Cox and Graham, 2009)</th>
<th>Actions to identify components in practice</th>
</tr>
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<tbody>
<tr>
<td><strong>Content Knowledge (CK)</strong></td>
<td>Knowledge of the possible topic-specific representations in a given subject area, independent of pedagogical uses.</td>
<td>Understanding central facts, concepts, theories, and procedures of explanatory frameworks that organize and connect ideas, rules of evidence and proof (Mishra and Koehler, 2006). Interpret and apply established practices and approaches toward developing such knowledge such as the scientific method and evidence-based reasoning (Koehler and Mishra, 2009). Use appropriate representations - i.e. Electron flow in science, graphs in math, or timelines in social science (Cox and Graham, 2009). Awareness of students’ prior knowledge of the subject, including common misconceptions or difficulties (Graham, Borup, and Smith, 2012).</td>
</tr>
<tr>
<td><strong>Pedagogical Knowledge (PK)</strong></td>
<td>Knowledge of the general pedagogical activities independent of specific content.</td>
<td>Employ strategies for motivating students, communicating with students and parents, presenting information to students, and classroom management (Cox and Graham, 2009). Select and implement methods of teaching and learning linked to objectives, values, and aims – i.e. Problem-based learning, peer instruction, etc. (Mishra and Koehler, 2006). Formulate and implement lesson plans and assessments (Mishra and Koehler, 2006). Nature of target audiences, and evaluating student understanding (Koehler and Mishra, 2009).</td>
</tr>
<tr>
<td><strong>Technological Knowledge (TK)</strong></td>
<td>Knowledge of how to use emerging technologies</td>
<td>Understanding of operating systems and computer hardware, use software tools such as email, installation, and removal of software programs, create and archive documents (Mishra and Koehler, 2006). Make use of technology productively at work, in everyday life, recognize when it can assist or impede the achievement of a goal, and capacity to adapt to changes (Koehler and Mishra, 2009).</td>
</tr>
<tr>
<td><strong>Pedagogical Content Knowledge (PCK)</strong></td>
<td>This combines knowledge of activities (or strategies) and knowledge of representations in order to facilitate student learning. Knowledge here is</td>
<td>Choose what teaching approaches fit the content and how elements can be arranged for better teaching (Mishra and Koehler, 2006). Represent and formulate concepts to facilitate learning and address misconceptions, student’s prior knowledge, theories of epistemology, predicting facilitative or dysfunctional aspects of a particular task (Mishra and Koehler, 2006).</td>
</tr>
<tr>
<td><strong>Technological Content Knowledge (TCK)</strong></td>
<td>content specific and situated in a particular subject area.</td>
<td>Ensure Constructive alignment and adaptation of instructional materials to alternative conceptions and students’ prior knowledge (Koehler and Mishra, 2009). Understanding the topic-specific representations in a given discipline and how they might be used as part of the teaching activities to promote student learning. Knowledge of how well that particular activity will work to help students understand that particular concept (Cox and Graham, 2009).</td>
</tr>
<tr>
<td><strong>Technological Pedagogical Knowledge (TPK)</strong></td>
<td>Knowledge of the topic-specific representations in a given content domain that utilize emerging technologies. Make use of digital tools that afford varied representation and manipulation of data in new and fruitful ways – i.e. X-rays, GraphCalc, Google SketchUp (Mishra and Koehler, 2006). Show deep understanding of ways in which the subject application of particular content can be changed by particular digital tools, or how tools can influence or constrain one another (Koehler and Mishra, 2009).</td>
<td></td>
</tr>
<tr>
<td><strong>Technological Pedagogical Content Knowledge (TPACK)</strong></td>
<td>Teacher’s knowledge of how to coordinate the use of subject-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. Select technologies that: Transform content to specific instructional strategies (i.e. microscope for inquiry science, weblogs for case-based learning in history, etc.), Fit learner content understanding (such as prior knowledge or learning styles), Transform content representations for teaching (i.e. Multimodal with digital storytelling, Google Earth for geography, etc.) (Graham et al., 2012). Show understanding of what makes concepts difficult or easy to learn and how technology can help, or how technologies can be used to build on existing knowledge and to develop new epistemologies or strengthen old ones (Koehler and Mishra, 2009; Mishra and Koehler, 2006).</td>
<td></td>
</tr>
</tbody>
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4.7.3 A meaningful framework for PD for technology integration

In the same way that being a content matter expert does not always translate into being an excellent teacher, knowing how to use technology tools or software does not necessarily lead to good teaching with technology. A scenario for pedagogically sound uses of educational technology is one where learning outcomes guide the design of tasks and inform the consequent selection of technological tools to support students in achieving those objectives. In this way, instructional planning can be focused on facilitating student’s learning, rather than on providing techno-centric learning experiences which may divert the attention away from core content (Harris and Hofer, 2009). In order to build such capabilities, educators require PD and support opportunities directly connected to their curriculum and practice (Baran, Canbazoglu-Bilici, and Uygun, 2016). Mishra and Koehler (2006) advise against technology training workshops and courses as they are “ill-suited to provide deep understanding that can assist teachers in becoming intelligent users of technology for pedagogy” (1032). But what is the best method to implement PD for effective technology integration?

Many efforts have gone into investigating this question and the literature clearly suggests that there is no single approach that fits all contexts and scenarios. This is primarily due to teacher knowledge being a collection of private and personal experience, as well as content-specific knowledge (Harris, 2016). There are also barriers to sustainable PD outcomes that need to be addressed including the availability of resources, teachers’ knowledge, abilities, in addition to teachers’ attitudes and beliefs (Ertmer et al., 2012). Moreover, institutional politics and culture, along with governmental regulations for quality and accountability are important considerations in successful PD implementation (Harris, 2016; Wang et al., 2014).
Under these circumstances, having a meaningful framework is a basic necessity for research into the field of educational technology to be replicable, effective and impactful, (Schmidt et al., 2009). This is the main reason the TPACK framework became so popular amongst the research community: before 2006, the field had no framework to ground its theoretical roots. What is more, the framework has been shown to be a useful lens for researchers to examine the development of pre-service and in-service educators (Archambault, 2016). TPACK is a useful framework to understand the process of technology integration and is also a practical guide for the design of effective PD efforts to enhance the use of educational technology in teaching practice. The focus of this chapter now turns to exploring the strategies and approaches used to develop technology integration practice in higher education.

4.8 Models of TPACK development

Over the last eleven years, the TPACK framework has been most commonly utilized across the globe to develop PD approaches to support practicing K-12 teachers and pre-service teachers, resulting in a series of suggested approaches for implementation. Harris (2016) conducted a systematic review of the literature, which culminated in a comprehensive overview of TPACK-based PD for teachers. Each of the approaches and strategies listed below can be adapted to fit specific contexts. A relevant gap in the literature is an evident paucity of studies specific to TPACK development for in-service university teachers (Herring et al., 2016). However, there are some noteworthy considerations noted at the end of this section.

4.8.1.1 Pedagogical Content Knowledge (PCK) focused model

This model is more overtly structured than collaborative instructional design approaches with an emphasis on analysis of teaching practice (Harris, 2016). Examples of this model include the instructional modelling approach, the collaborative lesson study, and collaborative curriculum materials development approaches.
Jamani and Figg (2013) designed the instructional modelling approach which is implemented by academic developers who model curriculum-based, technology infused learning experiences for participants. The authors called the approach the TPACK in practice framework which focused on supporting TPACK, TCK and TPK as the essential knowledge components. Jamani and Figg (2013) also report that their approach is effective in supporting technology-enhanced teaching, given that by the end of their workshops, teachers reportedly were ready to teach with technological tools, rather than just having the skills to use technological tools.

The collaborative lesson study was implemented in the K-12 context and involved teachers planning, observing, critiquing and revising each other’s teaching (Groth, Spickler, Bergner, and Bardzell, 2009). It is very similar to the peer coaching model. Groth et al. (2009) found this approach provided “a means for assessing the TPACK exhibited by a group of teachers as they immerse themselves in the simultaneous study of content, technology, and pedagogy” (p. 408).

Allan, Erickson, Brookhouse, and Johnson (2010) designed the collaborative curriculum materials development approach to support middle school science teachers in Maine as part of the EcoScienceWorks project. In this approach, teachers planned, observed, critiqued and revised each other’s teaching materials. The approach was found to be effective in increasing technological, pedagogical and content knowledge, provided insights into the use of simulations for teaching and resulted in the development of teachers as leaders within their schools.

4.8.1.2 Technological Pedagogical Knowledge (TPK) Model

This model is grounded in the exploration of the affordances and constraints of particular digital tools, as well as in helping teachers to develop technological solutions to pedagogical problems (Harris, 2016). An example of this method is the technology mapping approach. Developed by Angeli and Valanides (2009), the
technology mapping approach guides teachers to identify content-based problems of practice as learning objectives. These objectives are then used to inform the selection of appropriate tools which are used to transform confusing content into powerful representations for students. The approach was used with pre-service teachers and was found to significantly increase ICT-TPCK competencies.

### 4.8.1.3 Reflective/Reflexive Model

This model is enacted in communication with other educators and is focused upon in-depth and ongoing reflections within a specific teaching context (Harris, 2016). Some approaches under this model include the teacher inquiry/action research, the case development and the TPACK self-assessment approaches.

The Distributed Collaborative Research Model (DCRM) was described by Pierson and Borthwick (2010) as an action research model to guide teacher inquiry. Teachers across different higher education institutions used a data base for the systematic exploration of teaching and learning, guided by their own focus and interests. Pierson and Borthwick (2010) found this model to be a promising assessment approach to evaluate the effectiveness of PD efforts to support educational technology.

The use of case narratives as an approach to support teacher learning was investigated by Mouza and Wong (2009). This approach was implemented within the context of a graduate level course and focuses on supporting technology integration by helping teachers reflect on their technology use and learn from their practice. The approach was found to be effective in helping teachers understand fit. It was also useful in helping teachers question their assumptions and reconsider their beliefs.
Krauskopf, Foulger, and Williams (2018) introduced an approach that used a periodic self-assessment instrument to guide two German K-12 teachers to reflect on their own knowledge, teaching practice and their influence on their own context. This reflection was then used to direct individualized PD efforts. The approach was found to create meta-conceptual awareness in teachers, helping them identify and articulate areas for improvement in order to develop action plans to improve their practice.

4.8.1.4 Problem Based Model

This approach situates professional learning within an authentic classroom and school environments and is often based on collaborative work in small teams (Harris, 2016). Each team identifies multiple approaches to addressing a problem, selects/designs a solution, then implements it. The team later reflect as a group and adjust the approach (Harris, 2016). Team members share outcomes and reflections.

The curriculum-based, authentic, problem-solving approach introduced by Yew and Shing (2011) used a problem-based approach to guide teachers to discuss challenges and implement solutions based on pedagogical approaches to help students achieve learning outcomes. This approach was found to support teachers’ understanding of fit and to help them articulate their view of teaching and learning.

4.8.1.5 Computer Adaptive Model

This model is based on providing adaptive and personalized, fully online solutions to TPACK-based PD (Harris, 2016). The Geothentic and eTPACK are noteworthy examples of this approach.
Designed and implemented by Angeli, Valanides, Mavroudi, Christodoulou, and Georgiou (2015) eTPACK is a self-paced, adaptive series of curriculum and classroom-based design scenarios. These scenarios are at varying levels of completion that are presented to teacher learners within a virtual environment. User's responses to personalized prompts and self-regulated learning guide the program's selection of scaffolding for professional learning within the system.

Doering, Veletsianos, Scharber, and Miller (2009) presented GeoThentic, an online geography-learning environment for both students and K-12 teachers that utilize geospatial technologies. It includes a three-part teacher interface that analyses teacher reported, program-assessed, and user-path data to produce individualized professional learning profiles. There is also a workshop delivered to teachers on how to use GeoThentic. The study found TPACK to be a meaningful, user friendly tool to help teachers enhance geospatial technology integration in their classrooms by helping them articulate their teacher knowledge, strengths and improvement opportunities.

4.8.1.6 Instructional Planning Model

This model occurs within the scope of an educator's daily work. It involves a closer examination of instructional planning of lessons, problem-based unit development, and self/peer evaluation (Harris, 2016). An example of this method is the leaning activities types approach. Harris and Hofer (2009) recommended that PD support to enhance uses of educational technology be consistent with the planning process of educators. The approach suggests that learning can result from choosing appropriate learning objectives to guide pedagogically sound decisions about the nature, selection, and sequencing of tasks that conform the learning experience. In addition, the learning objectives should inform the selection of formative and summative assessment strategies, and resources including technological tools. This approach is focused on achieving learning outcomes rather than on the technology itself and is similar to the Activity-Centred design approach described in chapter 3.
4.8.1.7  **Workplace Learning Model**

Harris (2016) argues that this may be one of the most authentic forms of TPACK development, but its progress is challenging to document and to assist, due to differing interpretations and enactments between members of a professional community. It follows the guidelines of the community of practice model in which educator’s TPACK is shaped by collaborative processes of identity development and practice that is contextually based.

4.8.1.8  **Collaborative Instructional Design Model**

Initially, Mishra and Koehler’s (2006) recommendation for TPACK development was a learning technology by design approach in which lesson planning and subject designs were a collaborative effort between teachers and learning specialists. The approach is based on the situated cognition theory, “a theoretical perspective that acknowledges that knowing is an activity that is codetermined by individual-environment interactions” (p. 1034). Learning technology by design is based on the co-creation of design-based activities which blend theory and practice by placing emphasis on the learning process that results from the collaborative construction of teaching and learning artefacts. The focus is on learning by doing and on more comprehensive ways to teach design. This approach links PD activities to curriculum specific needs and provides a rich context for learning that enables sustained inquiry and revision (Harris et al., 2010; Mishra and Koehler, 2006). Learning technology by design also stresses the view that educators are thinkers, problem solvers, and planners, makes pertinent more in-depth discussions about learning theory and encourages the articulation of pedagogical reasoning (Mishra and Koehler, 2006; Smart, Finger, and Sim, 2016).
4.8.1.9 **The Sustainable Development of Faculty approach**

This approach was introduced by Herring et al. (2016) and it is noteworthy because it is specifically prescribed for the context of higher education (Figure 4-6). This approach resulted from a systematic analysis of the literature and is a synthesis that outlines ten suggestions for TPACK development in higher education, which can be applied for both teacher education and the development of administrative staff.

![Sustainable Development of Faculty's TPACK](image)

*Figure 4-6 Sustainable Development of Faculty's TPACK. Taken from (Herring, Meacham, & Mourlam, 2016, p. 218).*

4.8.1.10 **Leadership of Theory Action Plan**

Another comprehensive approach for TPACK development in higher education is based on Thomas, Herring, Redmond, and Smaldino (2013) Leadership Theory of Action plan. This approach had as main objectives to establish a vision for technology integration, provide PD for faculty members to accomplish that vision and to redesign the organization to support members’ work toward the vision. The
Theory of Action plan provides specific suggestions for leaders to engage all pertinent stakeholders in institution-wide change (*Figure 4-7*).

<table>
<thead>
<tr>
<th>How will change happen?</th>
<th>What can we control?</th>
<th>Zone of wishful thinking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leadership Team’s Learning (TPACK)</td>
<td>Human Resources (faculty, staff, etc.)</td>
<td>Favorable policy environment (institutional &amp; external)</td>
</tr>
<tr>
<td>Leadership Practice</td>
<td>Fiscal Resources (allocation &amp; incentives)</td>
<td>Additional resources (incentives, operating funds, etc.)</td>
</tr>
<tr>
<td>Faculty Learning (TPACK)</td>
<td>Personal Resources (time, messages, political capital, attention, etc.)</td>
<td>Faculty willing to allocate time &amp; attention necessary</td>
</tr>
<tr>
<td>Faculty Practice</td>
<td>Engagement with internal/external/initiatives/partners</td>
<td>Culture of partner schools conducive to goal</td>
</tr>
<tr>
<td><strong>Goal:</strong> Pre-service teachers’ learning and practice (TPACK)</td>
<td></td>
<td>Scalability</td>
</tr>
</tbody>
</table>

*Figure 4-7 TPACK Leadership Theory of Action. Taken from (Herring et al., 2016, p. 209)*

All of these approaches provide specific suggestions for TPACK-based development, which can be used as a starting point for the design of PD programs aimed towards developing capabilities for technology integration by university educators.

### 4.9 The difference between pedagogical beliefs and knowledge

Evidence from the literature indicates that while pedagogical knowledge and learning design competencies are important, teacher beliefs play a crucial role in the decision-making processes that guide teachers practice. Beliefs can function as a filter for new knowledge with the potential to positively influence or prevent technology integration practices (Kagan, 1992; Tondeur et al., 2017). To arrive at a holistic understanding of the factors that influence technology integration, the current study design is structured to explore the link between what teachers think (teachers' beliefs), what they know (TPACK) and what they do (teaching practice).
The intention is to gain insights into the process by which espoused beliefs about technology integration are enacted in behaviour. As such, it is critical to highlight that pedagogical beliefs are not the same as pedagogical knowledge, and each have a specific influence on teaching decisions and actions. This distinction is described below.

Kagan (1992) argues that knowledge can be regarded as beliefs that have been confirmed as true by objective proof or consensus of opinion. Khader (2012) and Petko (2012) refer to beliefs as subjective explanation systems as opposed to factual knowledge. Ernest (1989) also adds that knowledge is the cognitive outcome of education while beliefs and attitudes represent the affective outcome. Pajares (1992) proposes that "beliefs are based on evaluation and judgment; knowledge is based on objective fact" (p.313). For the purpose of the current study, the difference between beliefs and knowledge is understood as follows,

"... beliefs generally refer to “suppositions, commitments, and ideologies,” knowledge refers to “factual propositions and understandings”. Therefore, after gaining knowledge of a proposition, we are still free to accept it as being either true or false (i.e., believe it, or not)" (Ertmer, 2005, p. 28).

What is more, Abelson (1979) offers seven characteristics that could potentially help differentiate beliefs from knowledge. Beliefs are non-consensual, meaning that by nature, beliefs may not reflect objective truth or agreement with other people’s beliefs. This lack of reliance of objective truth often result in beliefs being referred to as ideals, or to the possibility of the existence of a concept without previous fact checking. Beliefs can reflect evaluative and emotional aspects, are infused by personal experience, tend to vary in levels of certitude and often have open boundaries which may make them unclear.

Because beliefs can act as filters for incoming information, they are able to influence motivation, self-efficacy and perceived value of technology according to assumptions of how discipline specific content should be taught. As such, it is argued that beliefs may have more influence on teaching practice than discipline specific
knowledge, given that educators’ daily instructional decisions can often be based on what they believe (Ottenbreit-Leftwich et al., 2010; Pajares, 1992).

In spite of the extensive research on the nature of technology integration practices, as well as the diversity of PD approaches that attempted to overcome the aforementioned barriers, there are still few studies that report tangible, concrete and institution-wide improvements to the quality of technology use in teaching and learning. A possible explanation may be found in the complexity and diversity of individual teaching practice. It has been observed that there is not a direct link between espoused beliefs about teaching and enacted teaching practice (Kember, 1997). For instance, teachers may espouse student-centred beliefs about how technology can be used, but observations show that these beliefs are not enacted in practice (Ertmer and Ottenbreit-Leftwich, 2010).

The discrepancy between espoused beliefs and enacted behaviours may be due to the nature of beliefs. For example, Ottenbreit-Leftwich et al. (2010) argue that the problem may be due to conflicting beliefs, or the difficulties in measuring beliefs. Ertmer (2005) argues that the issue arises from misjudging or misrepresenting exactly which beliefs are influencing which actions, while Ernest (1989) attributed this distinction to the depth of the espoused beliefs, the teachers’ level of consciousness of their own beliefs, as well as the influence of the social context.

Another possible explanation for the discrepancy between espoused and enacted uses of technology in higher education may partly be due to contextual factors or lack of PD. Given that university teachers traditionally may have little formal PD, they may lack the knowledge to integrate technology in their teaching in pedagogically effective ways. Conole and Jones (2010) argue that the gap between the potential use of technologies and the reality of how it is actually used to support learning is often due to a lack of understanding, but also a lack of guidance on how to integrate educational technology. Norton et al. (2005) propose three explanations: the first is that teachers may be frustrated with how contextual
constraints limit their teaching styles or instructional objectives; also, teachers’ true beliefs may be represented in their practice rather than in their self-reports of espoused beliefs; and finally teachers may lack training. Liu (2011) also argues that the discrepancy is due to lack of competence, time constraints and contextual factors.

Because of the importance of beliefs in decision making, reflection can have a profound influence on changing existing pre-conceptions. Hativa and Goodyear (2002) affirm that “practitioners change their practice and improve by becoming aware of their theories of action, that is, of the sources of their actions, of their underlying assumptions, values, and attitudes. Teacher’s lack of awareness of the sources of their actions may pose a threat to their practice” (p. 343). As a result, teachers should be supported to continually self-examine their own beliefs, given that reflection has been found to be a useful strategy for lowering cognitive affective filters (Dydowicz, 2015). Creating self-awareness through reflection is a strategic objective of the PD program designed for the current study as a method to facilitate an enhancement of competencies.

4.10 Chapter Summary

Despite a number of shortcomings, it is clear that due to the descriptive, inferential and applicative benefits of TPACK, it can be a useful framework to understand, structure and predict the outcomes of PD implementations for technology integration. The framework provides a comprehensive and integrative approach to designing PD to support uses of educational technology, challenging the prevailing sentiment that subject matter knowledge is sufficient for quality teaching in HE. It also urges for PD efforts to move away from the workshop or techno-centric approaches, which can be disconnected from classroom application, towards practice-based approaches.
Up to this point, each chapter in this thesis has provided the basis of understanding of important considerations for PD. Now the chapter will describe the PD program designed for the current study.
5 Description of the Professional Development Program

The PD program used in the current study was based on a collaboration between the researcher and university teachers. Such collaboration allowed for an authentic exchange aimed at supporting teaching practice in face-to-face and fully online subjects.

5.1 A beliefs centred PD program to support the use of educational technology

The PD program developed for this study takes into consideration the design elements detailed in Chapter 2.6. The main objective of the program was to support teaching competencies to enhance the use of educational technology while making explicit pedagogical beliefs. Before proceeding, approval for the study was gained from the University’s human research ethics committee. Figure 5-1 presents a flowchart depicting the actions taken throughout a semester-long implementation of the PD program during the third and final iteration. Each of these actions is described as follows:

Step 1 – Recruitment of participants: The recruitment strategy involved posting an advertisement in the University’s staff newsletter calling for expressions of interest. The invitation followed human research ethics protocols, indicating that participation in the program was voluntary and that participants were free to withdraw at any stage without prejudice. It also indicated that the program was free, flexible, available across all faculties of the university, and focused on enhancing individual teaching practice.

Step 2 – Expression of interest: The objective of this step was to obtain a time commitment from participants and to set up a safe, clearly delineated space for the purpose of discussing teaching practice. Potential
participants sent expressions of interest via email, requesting further information. In response, they were provided with a detailed explanation of the expectations of their involvement, a breakdown of the PD program, the plain language statement explaining the study and a consent form to sign as per ethics requirements.

**Step 3 – Welcome and diagnose:** This step involved an initial appraisal of participant’s confidence, their beliefs and their current learning designs. Upon receiving confirmation of participation from individuals, an email was sent from the researcher to formally welcome them to the PD program. As part of this email, participants received a link to the initial TPACK and Pedagogical Beliefs Assessment Instrument, which they were asked to complete (this took around ten minutes). Participants were also asked to send instructional materials such as, subject outlines, assessment task guidelines, rubrics, etc. to the researcher. These materials were analysed, and a list of strategic suggestions was sent back to the participant for their review prior to the first design consultation.

**Step 4 – Initial interview (individual):** To promote a culture of reflection from the start, the initial interview focused on revealing prior knowledge. Participants were encouraged to think back to their own learning experiences as students, with a focus on previous teachers and learning technology. The interview prompted participants to identify how prior learning experiences may have shaped their current teaching practice. Reflection was triggered by having participants review and comment on the results of their own initial diagnostic. This also allowed them to identify their own needs.

**Step 5 – First design consultation:** This session was based on a critical discussion of the current learning design of subject(s) the participant taught. The objective was to collaboratively create an action plan for improvement. Participants were asked to reflect on previous experiences of implementing tasks and assessments into their curriculum. A list of suggestions based on broad pedagogical approaches and technological tools, informed by the
initial document analysis, was then presented to participants. The list was used to trigger discussion and to enable a shared vision for the enhancement of the participants’ subject to be developed. By the end of the session, an agreed action plan was created to guide the design consultations for the rest of the semester.

**Step 6 – Design consultations (individual):** The implementation of the PD program was achieved through a series of hour-long consultations based on collaboration and careful consideration of delivery methods. Design consultations were flexibly scheduled around participants’ time availability and were situated in participants’ office or classroom. Each consultation followed the model of a flipped classroom. Prior to a session, participants were sent a link to the PD website that provided background information on specific pedagogical approaches or tools to be discussed (http://tpack4learningdesign.wordpress.com). The first ten to fifteen minutes of the face-to-face session were used to introduce or hold a hands-on-practice session with, a specific educational technology tool relevant to potential changes. Evidence-based information on the pedagogical approaches or tools was then reviewed as updates to the learning design were made. Often, videos of expert performance from the PD website were used to trigger discussion on implementation tips and best practice. Towards the end of the design consultation, the focus turned to a think-aloud method to guide participants towards setting goals for the implementation of the updated learning design. The next design consultation was scheduled before the end of the session.

**Step 7 and 8 – Classroom observations and reflection on observations:** This step took place over two consultations. In the first session, the facilitator visited the participant’s teaching environment and video recorded a lecture, tutorial or online webinar. The facilitator also filled out the Technology Integration Assessment Rubric for classroom observations and took notes. A second session at a later date was used to show the participant key sections of the recording. The objective was to have participants reflect on their performance in order to
identify potential areas for improvement. This discussion was guided by the facilitator and provided positive, constructive feedback directly linked to evidence-based strategies explored in the previous consultation. By the end of the session, participants had created an action plan for change.

Step 9 – Mid-way program interview: Similar to the initial interview, this step responded to the critical element of reflective practice. As part of an ongoing effort to make explicit pedagogical beliefs, the session started with a summary of the initial interview to trigger reflection. The interview focused on encouraging participants to express their epistemological beliefs, with a specific focus on participants’ ideas of learning and assessment. Participants were then asked to describe how they perceived themselves as students and were gradually guided to reflect on how their student experiences may have shaped their current teaching personas, as well as how that perception might influence their current interaction with students.
Figure 5-1 A flowchart depicting the actions taken throughout a semester-long implementation of the beliefs centred PD program developed for the study. This representation depicts the implementation of the PD program over one semester (one iteration) and shows the actions taken for the third and final iteration of the program.
Step 10 and 11 – Class observation and think aloud session:
The class observation followed the same procedure as step 7 above. The follow up session immediately after, however, used a think-aloud process. The facilitator played thought-provoking sections of the recorded lecture back to the participant. Questions were then used to guide the participant’s vocalized reflection based on observations of their own performance. The facilitator made detailed notes of the session, which were shared with the participant. At the end of the session, the participant was asked to decide on an action plan for improvement based on their reflection.

Step 12 – Focus group with students: At the end of the semester, the facilitator invited students enrolled in participants’ subjects to a semi-structured focus group to gather information on their perceptions of the learning experience throughout the semester. Participation in the focus group was voluntary. The questions asked covered overall satisfaction with the subject, their experience with assessment tasks, the usefulness of digital tools on learning, and feedback on teaching practice. Focus group data was then anonymised and summarized before making it available to the participant during the summative evaluation of the subject (step 13).

Step 13 – Summative evaluation of subject: The objective of this session was to support participant’s ability to evaluate the effectiveness of their subject in terms of impact on student learning. The session started with a quick review of changes made to the subject’s learning design. Analytics obtained from the learning management system (LMS) were then accessed to identify patterns of online behaviours based on student interactions with the subject LMS site (especially if the case involved an online subject). Student feedback from the focus group was used to supplement the evaluation. The session was designed to conclude with the creation of an action plan to continue improvements beyond the PD program.
**Step 14 – Post diagnostic:** This step involved a final appraisal of participants’ confidence, competencies, beliefs, and subject learning designs. The TPACK and Beliefs Assessment Instrument was completed by participants again. This enabled a pre-post comparison to be made of the results. Moreover, the final version of learning materials on the LMS subject site was accessed for a post document analysis.

**Step 15 – Final Interview:** This interview began with a recap of the objectives of participation in the PD program. Then, findings from the pre-post diagnostic, confidence logs and document analysis were presented to the participant for review to ensure reliability while gathering participant’s impressions. Participants were then asked to provide feedback on the PD experience, as well as to report their self-perceptions of the impact of the PD on their teaching practice.

### 5.2 Chapter Summary

This chapter outlined the design and implementation of the PD program used in the current program of research. It describes the evidence-based elements that informed the design of the program, the specific actions required of participants, the actions taken by the facilitator in delivering the program, as well as the learning design approach promoted by the PD program. Note, however, that the focus in this chapter is on describing the practical implementation of the PD program. Chapter 8 will outline in detail the refinements to the PD program as a result of each iteration.
6 Research Methodology and Approach

The current study investigated how a PD program could influence university teachers’ use of educational technology in their teaching practice. A PD program was designed for the study to both draw on and influence the pedagogical beliefs and TPACK of university teachers. Three iterations of the PD program were implemented over the course of the study and data was collected from each iteration using a mixed methods approach. The findings of each iteration are reported through individual case study narratives and subsequently using a cross case analysis. This chapter reiterates aims of the research and discusses the methodological approach and research design employed in this program of research.

6.1 Research questions and methodological approach

The current study was guided by the following research questions:

1. What are the salient features that characterize an effective PD program in terms of influence on university teachers’ use of educational technologies?

2. What influence does the PD program have on teachers’ pedagogical beliefs and understanding of the intersection between technological, pedagogical and content knowledge?

3. What is the influence of the PD program on university teachers’ effective implementation of educational technology in their teaching practice?

A range of methodological approaches could be used to address these research questions. A postpositivist, experimental or analytical research approach, based on principles that guide scientific inquiries whereby observations are commonly made under controlled conditions, could potentially be used (Salomon, 1990). These approaches are often associated with quantitative methods and present
claims of knowledge based on cause and effect relationships, reductionism, detailed observations, measures of variables, and testing and refinement of theories (Creswell and Plano Clark, 2011). Most “hard” sciences adhere to the postpositivism paradigm. However, such a unified view of science does not align neatly with the objectives of the current study, which was to understand highly complex human phenomena such as technological and pedagogical practices and beliefs. In fact, a postpositivist approach stresses the need to identify, control and minimize all sources of bias in the inquiry (Greene, 2012). This degree of control would be difficult to achieve in the proposed research context.

An interpretivist or more qualitative research approach, such as narrative research, phenomenology, grounded theory and ethnography (Creswell, 2013) could also be employed. An interpretivist perspective is in part applicable to the current study, mainly due to its alignment with case study methodologies. However, given that this research needed to accommodate the complexity of teaching practice situated in diverse learning environments, and that the aim was to move beyond rich descriptions of the problem towards both an understanding of the problem and how practice could be improved, Design-Based Research was considered the most appropriate methodology.

Barab and Squire define Design-Based Research (DBR) as being:

"... concerned with using design in the service of developing broad models of how humans think, know, act and learn; that is, a critical component of design-based research is that the design is conceived not just to meet local needs, but to advance a theoretical agenda, to uncover, explore, and confirm theoretical relationships. Although providing credible evidence for local gains as a result of a particular design may be necessary, it is not sufficient. Design based research requires more than showing a particular design works but demands that the researcher [...] generate evidence-based claims about learning that address contemporary theoretical issues and further the theoretical knowledge of the field" (Barab and Squire, 2004, p. 5).
Based on this definition, DBR could adequately guide the current study, given that it has both an advisory and an explanatory purpose (Phillips, McNaught, and Kennedy, 2012). In the current study, the advisory purpose was to allow the research to inform evidence-based design principles for PD programs in higher education, as well as inform university teachers about ways to enhance their use of education technology in their teaching practice. The explanatory purpose could be seen as how the current study could contribute to our current approaches to designing a PD program to assist with the understanding of how pedagogical beliefs can impact on TPACK competences, teaching and learning practice.

Anderson and Shattuck, (2012) define high quality DBR using the following characteristics:

- Focuses on the design and testing of strategic interventions
- Involves multiple iterations
- Design Principles evolve through the iterations
- Is based in an authentic context
- Involves a collaborative partnership between the researcher and participants
- Is focused on impacting actual practice
- Employs mixed methods

A key component of DBR is its iterative nature (Anderson and Shattuck, 2012). A strength of DBR lies in the ability of researchers and practitioners to refine and adapt a hypothesis or solution to a problem through a process of formative evaluation (Barab and Squire, 2004).

Advocates of DBR in education also suggest that studies be situated in an authentic context, that collaborative partnerships be developed with participants, and that the focus could be not only on developing new understanding, but also on impacting actual teaching practice (Bakker and van Eerde, 2015).
DBR is typically interventionist in nature, meaning the researcher can be both a facilitator and an observer (Bakker and van Eerde, 2015). In the current study, this characteristic manifests in the researcher taking on the role of facilitator of the PD program, guiding participants according to learning design principles and pedagogical approaches. The researcher then observes the influence of that intervention on the participants’ teaching and learning context, through the collection, analyse and interpretation of data.

Finally, DBR encourages the use of mixed methods (Anderson and Shattuck, 2012). A mixed methods approach, which is characteristic of designs that include “at least one quantitative method (to collect numbers) and one qualitative method (designed to collect words) where neither type of method is inherently linked to any particular inquiry paradigm” (Greene, Caracelli, and Graham, 1989). A mixed methods methodology is more clearly defined as,

“...an approach to research in which the investigator collects, analyzes and interprets both quantitative and qualitative data (closed and open-ended information) integrates or combines the two approaches in various ways and frames the study within a specific type of design or procedure. Sometimes the researcher makes specific their philosophical assumptions and more often than not, they include a theory that guides the quantitative and qualitative strand of their research or both. Also, both strands need to be conducted using rigorous methods of data collection and analysis” (Creswell, 2015).

A mixed methods approach invites a dialogue about ways of interpreting the social world, the complexities of human phenomena, values, and context (Greene, 2012). Moreover, this approach best addresses problems, which include one or more of the following characteristics:

- where one data source may be insufficient,
- findings need further clarification or generalization,
- where a second method is needed to enhance a primary method,
• to back up a theoretical stance,
• or where a research objective is best addressed with multiple phases or projects (Creswell and Plano Clark, 2011).

Given the complexity of teaching practice, one data source was not sufficient. Findings needed to be verified and clarified through multiple data sources. The program of research presented in this study, therefore, employed qualitative and quantitative data collection methods embedded within a series of case studies. A case study is defined as, “an empirical inquiry that investigates a contemporary problem within its real-life context” (Ellinger, Watkins, and Marsick, 2005). A case study was considered to be one university teacher in a particular context and included an evaluation of the relationship between their instructional decisions, the learning designs in their subject, their uses of resources, and their impact on the teaching-learning process. The qualitative data strand explored pedagogical beliefs and actual teaching practice while being triangulated and complemented with the quantitative data that measured the impact of the PD program on TPACK competencies and self-efficacy. Data were collected at the beginning, during and at the conclusion of each case study.

The key features of DBR, described above, have been used to guide the program of research presented in this thesis. A Design Based Research approach, incorporating mixed methods and nine case studies was used in this study to investigate the influence of a PD program in university teachers’ pedagogical beliefs, TPACK and uses of technology. The research approach included three iterations, each lasting from six months to one year. The implementation of the PD program occurred during the first and second semesters of 2017 and the first semester of 2018. Each semester, a new, refined version of the PD program was implemented with different case studies. The details of the application of DBR in the current program of research, the research design and the data collection methods are presented in the following section.
6.2 Research design and data collection methods

6.2.1 Context and participants

The context of this research study is the University of Melbourne, one of the largest higher education institutions in Australia. The University has a student body of approximately 48,000 students undertaking postgraduate and undergraduate studies. It employs around 4,200 academic staff working in the following faculties: Engineering, Science, Medicine Dentistry and Health Sciences, Arts, Education, Fine Arts and Music, Business and Economics, Law, Veterinary and Agricultural Sciences, Architecture, Building and Planning (Melbourne, 2017).

University teachers at the University of Melbourne who were scheduled to deliver either blended or fully online subjects were invited to join the PD program and to participate in the study. Each recruited participant became the focus of a case study. Students enrolled in the participants’ subjects were also recruited to participate in focus groups to gather complementary insights into their perceptions of learning resulting from the instructional strategies they experienced in the subject during the semester.

During the first iteration of the PD program, the recruitment strategy for staff involved contacting the head of teaching and learning in each faculty of the University. These individuals were sent an email explaining the objectives of the current study and requesting assistance to identify potential participants with the following characteristics:

1. New teaching staff in need of support with their online or blended subjects.
2. Teaching staff experiencing low student performance or negative feedback from students about their learning experience.
3. Experienced staff interested in advancing their Technological and Pedagogical Knowledge to enhance the delivery of their subject matter.
4. Experienced staff interested in increasing their knowledge about how their pedagogical beliefs influence their teaching practice.

However, this proved to be an ineffective recruitment strategy as there were few responses. As a result, the first iteration of the study only included two case studies. In preparation for the second iteration, an advertisement was posted in the University’s staff newsletter inviting teaching staff to participate in the PD program and study. This strategy allowed the study to be better aligned with the theme of organizational culture found in the literature (For more information refer to chapter 2). This strategy proved to be more successful and was also used for the final iteration of the study.

6.2.2 Data collection sequence

*Figure 6-1* shows the sequence of the implementation of the PD program. This sequence, which is explained more fully in Chapter 5, is useful to show what data collection methods were used and at what point in the PD program for each case study. Throughout the implementation of the PD program data was collected using a variety of measures and instruments. These separate instances are represented in *Figure 6-1* and each is described below.
Figure 6-1 A flowchart depicting what data collection methods were used and at what point during one iteration of the PD program. This representation shows the third and final iteration of the program.
6.2.3 Data collection methods

The data collection methods used in this program of research included document analysis, three separate interviews with participants (teachers), a series of teacher surveys that included the TPACK and Pedagogical Beliefs assessment instrument, Teacher's Beliefs and Intentions Questionnaire and confidence logs, class observations, student focus groups, a research journal and Learning Management System (LMS) statistics.

6.2.3.1 TPACK and Pedagogical Beliefs Assessment Instrument

The TPACK and Pedagogical Beliefs assessment instrument is a 67-item survey administered to participants before and after the implementation of the PD program. The first section of the instrument was based on Schmidt et al. (2009)’s Assessment Instrument for Pre-service Teachers, an instrument that has been used to capture self-reports in relation to the knowledge components in the TPACK framework. In spite of criticism of the somewhat vague distinctions between PCK and TCK, a systematic study regarding its use reported, “significant correlations [...] the TPACK factors provided some evidence that the TPACK survey scores can be useful measures of the various aspects of teacher's knowledge” (Chai et al., 2016, pp. 90-91).

The instrument uses a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The original instrument contained 47 items but was specifically focused on diagnosing the competences of pre-service teachers. This was unsuitable to the current study's context because the participant sample were in-service university teachers. Therefore, the instrument was reduced to 26 items. The specific changes made to the instrument are detailed below, but note that a copy of the instrument is found in Appendix C:
• The section on demographic information was adapted to better suit university teachers. For instance, names and sex were excluded but age, the subject’s taught and years of teaching experience were included.
• The items under Content Knowledge were generalized to refer to “my discipline” rather than specifically relating to math, social studies, science and literacy, the four subject matters referred to in the original survey. As a result, this section was reduced to include only three questions rather than twelve. For instance, instead of saying “I have sufficient knowledge about mathematics”, the question was modified to say “I have sufficient knowledge about my discipline”.
• In the original instrument, the sections related to Pedagogical Content Knowledge and Technological Content Knowledge contained items such as “I can select effective teaching approaches to guide student thinking and learning in mathematics”. In the modified instrument, sections were generalized to refer to “my discipline” and included only one question rather than four.
• In the original version of the instrument, item 24 referred to a “teacher education preservice program”. The wording was changed to “my teaching experience and education” to be more suited to university teachers.
• Item 26 originally stated, “I can adapt the use of technologies that I am learning about to different teaching activities” (referring to preservice teaching program). “that I am learning about” was omitted to better suit the experience of more experienced educators resulting in “I can adapt the use of technologies to different teaching activities”.
• The entire section on Models of TPACK was omitted because it was considered that such questions could be better explored during interviews.
• Under Technological Pedagogical Content Knowledge, four questions (40-44) referred to specific disciplines. These were generalized to refer to “the subject matter”. As a result, three original questions were omitted from this section.
• Item 29 originally stated, "I can use strategies that combine content, technologies, and teaching approaches that I learned about in my
coursework in my classroom”. The last part of this question (that I learned about in my coursework in my classroom) was omitted.

- Item 30 was adapted given that the original questionnaire referred to “my school and/or district”. This reference was changed to “my faculty” to better suit the higher education context.
- The open-ended questions at the end of the TPACK questionnaire were omitted as these were to be explored in the interview.

The second section of the TPACK and Pedagogical Beliefs assessment instrument was designed to capture participant's self-reports on pedagogical beliefs. Capturing beliefs is a difficult task because most people find difficult to articulate their beliefs. An extensive literature review was conducted to identify an appropriate instrument. Initially, Schommer’s Epistemological Beliefs Questionnaire was considered due to its focus on exploring beliefs about the nature of knowledge and intelligence (Duell and Schommer-Aikins, 2001; Marlene Schommer, 1990). Schommer's instrument was disregarded, however, due to a number of reports from the academic community regarding concerns with validity and reliability (Arredondo and Rucinski, 1996a, 1996b), including claims that “it seemed impossible to replicate Schommer’s factor structures” (Clarebout, Elen, Luyten, and Bamps, 2001, p. 74). Instead, Norton et al. (2005)’s Teacher's Beliefs and Intentions Questionnaire was selected. This decision was based on claims that the questionnaire can help “both new and experienced teachers to articulate their beliefs about teaching and to reconcile those beliefs with the demands and the constraints of the academic context in which they are required to teach” (p. 562). Moreover, other empirical studies reported the questionnaire to be a reliable instrument (Rienties et al., 2013; Rienties et al., 2014).

The Teacher's Beliefs and Intentions Questionnaire includes 36 items based on a Likert scale from 1 (strongly disagree) to 5 (strongly agree). It is designed to capture and compare beliefs and intentions focusing on learning facilitation versus knowledge transmission. The questionnaire is comprised of the following subscales:
problem-solving, interactive teaching, facilitative teaching, pastoral interest, motivating students, training for jobs, use of media, imparting information, knowledge of the subject. No changes or updates were made to the questionnaire (Appendix C).

The results from the TPACK and Pedagogical Beliefs Assessment Instrument were calculated by assigning the corresponding value from one to five according to the participant’s response on the Likert scale. The added value of all statements was used to calculate a percentage for each section. These results were then interpreted using the work of Schmidt et al. (2009) who provided descriptions of the purpose of each section in their instrument to interpret the numerical findings. Norton et al. (2005) did not provide descriptions of each section or subconstruct in their instrument; however, interpretations were derived based on the questions outlined for each section of the questionnaire (Table 6-1). Moreover, note that there are no expectations of the participants’ results. The aim is to capture any observed changes as a result of the PD program implemented in the current study.

This analysis allowed the researcher to write a narrative explanation of the participants’ teaching abilities based on the TPACK components and the duality between learning facilitation (student-centred) or learning transmission (teacher-centred). This narrative explanation was sent to the participant for their review. Then, during the initial interview, the participant’s perceptions of the narrative explanations were gathered and further explored. It in this way the assessment instrument and the initial interview are complementary data collection methods, which should be used in tandem.

Table 6-1 was created to guide the analysis of participants’ responses. The table outlines the purpose, and the total numerical value for each section of the TPACK and Pedagogical Beliefs assessment instrument.
Table 6.1 Breakdown of the sections in the TPACK and Pedagogical Beliefs assessment instrument that facilitated the analysis of responses from participants. Based on the work of Schmidt et. al. (2009) and Norton et. al. (2005)

<table>
<thead>
<tr>
<th>Section</th>
<th>Purpose</th>
<th>Calculated total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Introduction</strong></td>
<td>Gather demographic data from participants such as age, years of teaching experience and subject they teach.</td>
<td>Not applicable</td>
</tr>
<tr>
<td><strong>Technological knowledge</strong></td>
<td>Appraise teacher’s knowledge of how to use technology, which in the context of TPACK refers to digital tools such as computers, software programs, etc.</td>
<td>7 questions x max 5 points in Likert scale = 45 possible points.</td>
</tr>
<tr>
<td><strong>Pedagogical Knowledge</strong></td>
<td>Appraise knowledge based on methods and processes of teaching.</td>
<td>7 questions x max 5 points in Likert scale = 45 possible points.</td>
</tr>
<tr>
<td><strong>Pedagogical Content Knowledge</strong></td>
<td>Appraise ability to effectively communicate knowledge of discipline.</td>
<td>1 question x max 5 points in Likert scale = 5 possible points</td>
</tr>
<tr>
<td><strong>Technological Content Knowledge</strong></td>
<td>Appraise technological knowledge of how to use tools to communicate discipline specific content.</td>
<td>1 question x max 5 points in Likert scale = 5 possible points</td>
</tr>
<tr>
<td><strong>Technological Pedagogical Knowledge</strong></td>
<td>Appraise the ability to integrate technology into teaching approaches.</td>
<td>5 question x max 5 points in Likert scale = 25 possible points</td>
</tr>
<tr>
<td><strong>Technological Pedagogical Content Knowledge</strong></td>
<td>Assess fit.</td>
<td>5 question x max 5 points in Likert scale = 25 possible points</td>
</tr>
<tr>
<td><strong>Learning facilitation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Problem solving</strong></td>
<td>Appraise preference over teaching methods that aim at secondary type learning (e.g. memorisation) or tertiary type learning (e.g. problem solving)</td>
<td>4 question x max 5 points in Likert scale = 20 possible points</td>
</tr>
<tr>
<td><strong>Interactive teaching</strong></td>
<td>Appraise beliefs and intentions to motivate participation and engage students in critical discussion.</td>
<td>4 question x max 5 points in Likert scale = 20 possible points</td>
</tr>
<tr>
<td><strong>Facilitative teaching</strong></td>
<td>Appraise beliefs and intentions to help students ‘learn for themselves’ (Norton et. al, 2005, p. 566).</td>
<td>2 question x max 5 points in Likert scale = 10 possible points</td>
</tr>
</tbody>
</table>
Pastoral interest Appraise beliefs and intentions to recognise personal needs and interest for the wellbeing of students. 4 question x max 5 points in Likert scale = 20 possible points

Motivator of students Appraise beliefs and intentions to motivate students to learn. 4 question x max 5 points in Likert scale = 20 possible points

Knowledge Transmission beliefs and intentions

Training for jobs Appraise beliefs and intentions to prepare students to be qualified professionals in their future careers. 4 question x max 5 points in Likert scale = 20 possible points

Greater use of media Appraise beliefs and intentions to use audio-visual materials in lectures. 4 question x max 5 points in Likert scale = 20 possible points

Imparting information Appraise beliefs and intentions to pass on as much information as possible to students. 4 question x max 5 points in Likert scale = 20 possible points

Knowledge of subject Appraise beliefs and intentions to keep abreast of knowledge of the discipline. 4 question x max 5 points in Likert scale = 20 possible points

6.2.3.2 Confidence logs

Short surveys were used during the PD program to ascertain participants’ confidence in relation to skills and knowledge. The initial logs were collected prior to the design consultations to create a baseline. This baseline was then compared to the confidence logs collected mid-way and at the end of the program through a progress chart. There were two kinds of confidence logs, skills-based and knowledge-based, and both used a five-point Likert-scale measure.

The knowledge-based log intended to evaluate participant’s self-reported confidence in relation to learning theory pre-and-post implementation of the PD program. Participants were asked to rate their confidence, on a scale from 1 (I don’t know what this is) to 5 (I feel really confident), for the following topics:

- Active instructional methods
• Assessing active learning
• Flipped classroom
• Designing for learning
• Learning design evaluation
• Cognitive engagement
• Learning strategies
• Cognitive tools
• Enhancing online communication

Skilled based logs asked participants to rate their confidence to implement their learning designs. There were three logs collected on commencement, mid-way and at the end of each case study. The analysis was used to track and describe any evidence of self-reported changes in confidence influenced by the PD program. The log was based on a Likert scale from 1 (no confidence whatsoever) to 5 (very confident) based on the following pedagogical actions:

1. Review the learning objectives
2. Apply constructive alignment
3. Brainstorm active learning ideas to design tasks
4. Understanding of active learning methods
5. Designing active learning tasks
6. Selecting appropriate technology to support active learning
7. Use technological tools to enhance tasks
8. Evaluate the implementation of learning designs

6.2.3.3 The Technology Integration Matrix (TIM)

Originally created for K-12 schools by the Florida Center for Instructional technology, The TIM is a rubric that provides a framework to evaluate the quality of technology integration in a lesson or assessment task. The rubric is organized around a Y axis that includes five characteristics of meaningful learning environments (Active, Constructive, Authentic, Collaborative, and Goal-Directed)
each referring to a specific pedagogical approach. The X axis refers to five levels of technology integration (Entry, Adoption, Adaptation, Infusion, and transformation) (Welsh, Harmes, and Winkelman, 2011). Given the need to ensure validity and reliability in the evaluation of technology used by participants, the TIM was selected due to its simplicity and focus on active learning. The language used in it (i.e. transformation) was an initial concern given its similarity to ‘transformative’ frameworks that tend to polarize teaching practices. However, the TIM is not a tool to judge teachers or promote ideal practices. Rather, in this study, the focus is kept on evaluating tasks and their impact on the student experience.

6.2.3.4 Document analysis

Document analysis was used as a method to capture and evaluate the quality of learning designs underpinning participants’ teaching practice before and after the implementation of the PD program. The document analysis evaluated the quality of the instructional materials used in participants’ subjects. These documents were provided by participants themselves and were accessible via the LMS subject site. These materials included assessment guidelines, course outlines, rubrics, welcome emails, quizzes, and study guides. The first document analysis occurred prior to the first design consultation. The purpose was to evaluate the range of instructional strategies shaping a participant’s learning design(s). This allowed the researcher to come up with strategic suggestions to improve the curriculum design, with a special focus on assessment tasks. These suggestions were then discussed to create an action plan for the remainder of the design consultations.

The learning designs of participants needed to be captured in a methodologically sound manner. A review of the literature showed two comprehensive and prominent methods of capturing learning designs: an approach adopted by the Open University (Jameson et al., 2016; Rienties and Toetenel, 2016; Toetenel and Rienties, 2016) and the approach advocated by the AUTC Project on learning designs (Oliver, 1999; Oliver et al., 2002). The Open University uses a nuanced approach to
capturing, visualizing, planning, and evaluating learning designs, which incorporates learning analytics to evaluate mostly online subjects (Jameson et al., 2016; Rienties and Toetenel, 2016; Toetenel and Rienties, 2016). This approach is mostly suitable to fully online subjects with large cohorts and uses time on task as a measurement unit which is difficult to identify in blended learning environments. Consequently, this approach was deemed unsuitable to the current study because the majority of participants were teaching blended learning subjects with small to medium cohorts.

The AUTC project on learning designs, on the other hand, is a practice-based approach that addresses both blended and fully online subjects, which covered the subject mode of most participants in the current study (Oliver, 1999; Oliver et al., 2002). The AUTC Project on learning designs is well aligned to constructivist approaches to teaching and learning, encourages the use of student feedback as an indicator for improvement, and is easily adaptable to smaller student cohorts in blended learning environments (Oliver et al., 2002). It also breaks down a learning design into tasks, resources, and supports, and provides a format to visualise the design (see Figure 6-2).

The document analysis also took a structured approach to the evaluation of the quality of participant’s learning designs in order to compare and contrast learning designs before and after the PD program. Harris et al. (2010)’s Technology Integration Assessment Instrument (TIAI), a validated instrument, was used to assign a numerical value to the quality of learning designs. The instrument includes four criteria to assess technology use in LDs:

1. Curriculum goals and technologies which assesses curriculum-based technology use,
2. Instructional strategies and technologies which focuses on how technology supports instructional strategies,
3. Technology selection which assesses the compatibility of technology and instructional strategies,
4. Fit which focuses on how content, pedagogy and technology fit together.

The TIAI uses a numerical rating of learning designs, which represents quality in terms of the TPACK components, including the intersection of fit. When using the TIAI it is recommended that a detailed description of each activity design, given that instructional materials alone often do not provide the whole picture. Therefore, in the current study the learning design visualization were used in conjunction with the TIAI.

An analysis of the outcomes, and the learning and assessment tasks contained within a subject were translated into a learning design (LD) visualisation. This graphical representation showed the organization and structure of each assessment task within a subject, as well as the resources and supports used in its implementation. The LD visualization was supplemented with information obtained by speaking with participants. The findings from the initial document analysis were mailed to the participant for review and clarification. The Technology Integration Assessment Instrument was used to apply a numerical value to the quality of each LD (Harris et al., 2010). Quality here was measured as the degree of integration between content, pedagogy, and technology (also known as fit).
6.2.3.5 Initial teacher interviews

Hour-long, semi-structured interviews were conducted with participants at three points during the program (on commencement, mid-way and at completion). The interviews were audio recorded with participants’ consent, were transcribed verbatim and were coded to allow the researcher to reflect on participants’ comments prior to the next interview. An outline of the coding strategy used to analyse all the interviews is presented in appendix B.
The initial interview had three main objectives. The first objective was to get to know participants and to explain how the PD program worked. The second objective was to gather participants’ initial reactions to the results from the TPACK and Pedagogical Beliefs Assessment instrument. Participant’s reactions were then used to trigger reflection on their own teaching practice to help them identify potential areas for improvement. The final objective was to ask participants to describe their own student experiences with regards to previous teachers, instructional strategies and educational technology. This reflection allowed participants to identify how their own student experiences may have influenced their current teaching practice.

6.2.3.6 Mid-way teacher interviews

The mid-way interview began with a quick formative evaluation of how any of the suggested instructional strategies and redesigned instructional materials were impacting on the delivery of the subject. Participants were then asked to describe their own strengths and weaknesses as students and to explore how that awareness allowed them to understand their own students. The mid-way interview also asked participants to provide an explanation of how knowledge is created, and how this understanding is aligned with their instructional decisions.

6.2.3.7 Final teacher interviews

The main objective of the final interview was to gather participants’ self-perception of improvement and their satisfaction with the PD program. The results from the confidence logs, document analysis and the TPACK and pedagogical beliefs assessment instrument were presented back to participants to trigger a reflection process, as well as to verify the validity and reliability of the findings. The final interview concluded with a summative evaluation of the PD program focused on the themes of reflective practice, a focus on teaching practice, consider delivery methods, selection of technical infrastructure, organizational culture, and promote collaboration.
6.2.3.8 Class observation

In the first iteration of the PD program, the class observation was an optional method used upon request from the participant. It involved recording the participant’s lecture or tutorial, so at a later time, participants could reflect on their practice based on actual proof of their performance. As a complementary part of this observation process, a modified version of the TIAI was used to assign a numerical value to the quality of technology use in relation fit. The TIAI for class observations includes the following six criteria to assess technology use in the classroom:

1. Curriculum goals and technology: measures how aligned is technology to curriculum goals,
2. Instructional strategies and technology: focuses on how technology use supports instructional strategies,
3. Technology selection is observed as appropriate or inappropriate in relation to curriculum and instructional strategies,
4. Fit considers curriculum, pedagogy and technology together,
5. Instructional use: assesses effective uses of technology for instruction.
6. Technology logistics which captures effective operation of technologies.

During the first two iterations, only one class observation took place per case study, however, this method was reported to be a powerful aspect of the PD program by participants. So by the final iteration, the PD program was updated to include two class observations, one at the beginning and near the end of the semester. This allowed for a pre-post comparison analysis.

6.2.3.9 Student focus group interviews

A focus group was held with students who were enrolled in participants’ subjects to gather students’ self-perceptions of the impact of instructional strategies on their learning. Students also provided feedback on the teachers’ performance and on the
usefulness of the redesigned instructional materials or resources. The focus group was an hour-long, semi-structured and recorded with students’ consent. The focus group was transcribed verbatim and analysed using the coding framework in appendix B. Focus group sessions occurred at the end of the semester.

6.2.3.10 LMS statistics

Data was extracted from the learning management system (LMS) to provide an indication of the level of student engagement and interaction with a participant’s online subject. The platform provides reports on the number of logins to the platform, the times and days of access, the most visited resources, activities, and the student grades on each task. These data were used to support outcomes of the summative evaluation of the subject. It was also used as a resource to show participants how to track students at risk or inform partial or complete redesigns of their subject materials. LMS data was accessed once during the design consultations and again before the summative evaluation near the end of the PD program.

6.2.3.11 Research journal

A research journal was kept by the researcher, detailing accounts of each design consultation with participants. The purpose was to first compare and contrast the reports from the participants. If any irregularities were found in the data, the research journal was checked for evidence to account for them. For example, if during an interview a participant reported that support was not provided around a specific issue, the research journal was consulted to corroborate the information. The second purpose of the journal was to support the evaluation of the PD program at the end of each iteration. The research journal provided insights into the effectiveness of the strategies used in the PD program. Participant’s reactions to PD tasks were considered and discussed during the final interview. This provided evidence for the PD program to be evaluated and improved after each iteration,
6.3 Data integration and triangulation

This section focuses on explaining the relationship between the study context, participants, data collection methods and analysis strategies focused on answering each research question (RQ).

*RQ1: what are the salient features that characterize an effective PD program in terms of influence on university teacher’s use of educational technology?*

The following evidence-based themes were identified in the literature review and are the foundation of the PD program (For more refer to Chapter 2, section 2.5):

1. Promote reflective practice,
2. Focus on teaching practice
3. Consider delivery methods of the PD
4. Careful selection of technical infrastructure
5. Take into account organizational culture
6. Promote collaboration

The perceived relevance of each these themes, in terms of influence, was determined based on participant reports during the final interview. The pre-post document analysis, as well as the TPACK and Beliefs Assessment Instrument were also used to corroborate self-reports. RQ1 is predominantly based on a Qualitative approach strand with points of interface across data collection methods for complementarity triangulation (*Figure 6-3*).

The interviews were independently coded using NVIVO and thematically analysed. The codes were first identified in the literature review. The work of Graham, Borup and Smith, (2012) was influential given that their study provided a coding strategy which was used as an exemplar. However, as the interviews were transcribed and analysed new patterns emerged. The coding strategy can be found in Appendix B. A focused thematic analysis then used to identify conditions, causes, characteristics and patterns in each case study, which was subsequently used across case studies.
The patterns that emerged from the initial interview were also compared with those of the final interviews. The results of the thematic analysis were also compared with the findings from the pre-post document analysis and TPACK and Pedagogical beliefs Assessment instrument.

A research journal was kept by the researcher, detailing accounts of each design consultation with participants. The purpose of the journal was to use it to compare, contrast, or support other research findings that emerged from the analysis. If any irregularities were found, the research journal provided evidence to account for them. Moreover, the research journal provided insights into the veracity of each of the themes.

The findings from RQ1 were first used to identify improvement opportunities and refinements needed in PD program before the next iteration. The finding associated with RQ1 also provided valuable insights into how the emergent themes contributed to the influence of the PD program on TPACK competencies (RQ2) and actual technology integration practices (RQ3).
**RQ2:** What influence does the PD program have on teachers’ pedagogical beliefs and understanding of the intersection between technological, pedagogical, content knowledge?

Evidence for RQ2 emerged from a predominantly quantitative strand of data collection including confidence logs, the TPACK and Pedagogical Beliefs Assessment Instrument, and the document analysis. This evidence was used to evaluate the influences of the PD program on the relationship between teachers' beliefs and TPACK competencies. There are several points of interface due to the need to compare findings across interviews, focus groups, and the research journal (Figure 6-4).

Based on a pre-post implementation design, the TPACK and pedagogical beliefs assessment instrument provided a mechanism to diagnose and track any changes in competencies and beliefs. It also allowed the design consultations to be tailored to address participants’ specific needs. In addition, these findings were useful to trigger participants’ reflection process during the initial interview (For more information on the analysis of this interview, see section 6.2.3.1)

*Figure 6-4 Visual description of RQ2 analysis*
The pre-post document analysis started with the creation of a temporal format illustration for each assessment task (Figure 6-2). Then, the Technology Integration Assessment Rubric was used to guide the analysis of quality in terms of fit (Harris et al., 2010). The findings from the initial document analysis were mailed to the participant for review. The findings from the final document analysis were used to create a pre-post comparison chart and were presented to the participant during the final interview to trigger reflection and ensure reliability.

Confidence logs were also used to track any changes in self-efficacy in terms of pedagogical knowledge and competencies. The initial logs were collected prior to the design consultations to create a baseline for progress. This baseline was then compared to the confidence logs collected mid-way and at the end of the program and were visualized in a progress chart.

To ensure integration of the results, a secondary mixed-method analysis occurred. The TPACK and Pedagogical Beliefs Assessment instrument, the document analysis and confidence logs were triangulated with the data from the interviews with teachers, focus groups with students, and were corroborated with the research journal.

**RQ3: What is the influence of the PD program on university teacher’s effective implementation of educational technology in their teaching practice?**

Evidence to investigate RQ3 emerged from a both qualitative and quantitative data (Figure 6-5).
The primary qualitative data included the final interview, focus group and class observation(s). The final interview ensured the reliability and validity of the results by discussing the findings directly with the participants. It also informed the analysis of RQ1. The class observation was complemented with the Technology Integration Rubric (TIAI), which resulted in a numerical value based on the quality of technology use observed during a lecture. The student focus group was a complementary data source to corroborate the perceptions of participants own teaching practice. In addition, the focus groups, the document analysis, and the class observation informed the evaluation of technology use in tasks using the Technology Integration Matrix (TIM).

The quantitative data included the LMS statistics which were used as a complementary source of data to inform the summative evaluation of the subject. The assessment instrument and confidence logs were also used to corroborate and elaborate on the findings from the interviews.
Typology development was used as a strategy to identify patterns and facilitate the integration of qualitative and quantitative data. In mixed methods, typology development is the “corroboration analysis of the different data types to be conducted independently and then compared for convergence at the level of conclusions and interpretations” (Caracelli and Greene, 1993). Data were integrated using strategies of complementarity, triangulation and elaboration proposed by Greene, Caracelli, and Graham (1989).

Rich, descriptive, narrative case studies were then written. The analysis of each case was integrated into a coherent narrative (see chapter 7). The collection of similar data across the case (e.g. confidence logs, TPACK and pedagogical beliefs) provided a mechanism to evaluate of changes over time. Iterative reflection resulted in refinements to the PD program after each iteration. These refinements are described in detail after case one, case two and case seven. The cross-case analysis (Chapter 8,) drew from all cases to more explicitly address the three main research questions.

### 6.4 Chapter summary

This chapter has presented the methodological foundation of the research approach and design for the current study. A Design Based Research approach was adopted due to its iterative nature and mixed methods approaches. The next chapter will introduce the analysis and findings of each case study.
7 Individual Case Study Analysis

This chapter is focused on integrating the findings from the mixed methods analysis into individual, comprehensive and coherent narratives of each case study. This chapter is divided into nine sections, one for each of the case study participants who are described using a pseudonym. Each case study follows a standard Teacher beliefs (Think), TPACK (Know), Teaching practice (Do) format focused on exploring participants’ teaching behaviours before, during and after the PD program.

In each case study, a macro learning design of the subject participants were teaching at the time of the PD program is presented, and depicts the topics, delivery mode, assessment tasks (AT), as well as the PD program activities that took place throughout the semester. Changes as a result of the program are labelled using a yellow delta sign, which will be found throughout the text to highlight the nature of the influence of the PD program in participants’ teaching practice. A summary of the findings will also be found in the discussion section at the end of each case study.

7.1 Case Study 1 - Analysis of Findings

7.1.1 Participant description

Leo has over 14 years of experience teaching blended learning subjects. He is an accomplished writer who specializes in screenwriting for television and theatre. At the time of his participation in this PD program, in addition to being a full-time academic, he was completing a Masters in Theatre Practice, which helped him to renew his understanding of what it feels like to be a student.

Leo began his teaching career in 2002 teaching short courses for a television agency before moving into higher education in 2007. Since then, Leo has been involved in
developing the curriculum and teaching in the Film and Television Bachelor's degree. Technological support for teaching and learning is made available by the University in the form of PD workshops and consultations with learning designers, but staff members in his faculty rarely participate due to their off-campus location. Performance reviews also occur once a year and all staff members are expected to participate.

Leo expressed his motivation to participate in this PD program as follows,

“For the last couple of years, a lot of my strategizing involves finding ways to streamline things. Now, I am interested in finding further ways of streamlining things. That may be using technology to help me without students realizing it. You know what I mean? So they still feel great. When they get me, they get me 100% but they don't get me a 100% of the time if that makes sense” (initial interview).

7.1.2 About the subject

Leo taught two complementary first-year subjects: Subject 1a and subject 1b. Both of these subjects are part of the Film and Television Bachelor of Arts degree. Because the subjects were delivered to the same cohort of approximately 20 students during the same semester, and some of the assessment tasks were intertwined, Leo requested both subjects to be the focus of his involvement in the PD program.

The main objective of subject 1a is to introduce students to the nature and culture of the film and television industry. The design of this subject is based on project-based learning and is composed of four main assessment tasks. There is no final exam.

Subject 1b is focused on introducing student to the basic techniques of the screenwriting craft. The subject is also project-based learning and is composed of three main assessment tasks. There is no final exam.
The macro learning design of the subject is displayed in *Figure 7-1* and it is colour coded. The solid yellow boxes highlight the sequence of PD activities implemented throughout the semester as part of the PD program. Blue or fuchsia boxes depict a directed, lecture mode of delivery, while the green boxes represent interactive tasks that include peer feedback. The ovals represent the inquiry based or experiential assessment tasks. The delta symbol in yellow draws attention to changes as a result of the PD program and will be found throughout the text to highlight the nature of the influence of the PD program in the participant’s teaching practice. *Table 7-1* provides a description of the subject’s objectives and tasks.
Figure 7-1 Case 1: Learning design subject 1a and subject 1b including a map of the sequence and influence of the PD program in the participant’s teaching practice.
### Subject 1a

This subject is an elective in the Bachelor of Fine Arts in Film and Television and is complementary to screenwriting practices.

**Subject Overview**

Through film screenings, lectures with local visiting filmmakers and participation in selected craft workshops, this subject introduces students to broader screen and television industry practices. Students also develop formal and informal skills in giving and receiving critical feedback on creative work. This subject includes an embedded program in academic literacy skill of analysis, discussion, research and information retrieval.

**Learning Outcomes**

At the completion of this subject students should have acquired the following skills:

- Plan and organize their work and solve problems
- Apply theoretical knowledge to practical tasks
- Develop positive self-critical and peer review skills
- Present opinions and analysis in a group context
- Demonstrate effective time management skills
- Demonstrate a broader understanding of the filmmaking landscape
- Critically and constructively review their own and peers' creative work
- Use their knowledge of screen practices to feed into their own creative writing.

<table>
<thead>
<tr>
<th>Assessment Task (AT) description</th>
<th>Deadline and grade %</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT1 Directing Actors Workshop Exercises: Assessment based on performance, attendance and participation at a workshop</td>
<td>Due Week 9 – 20%</td>
</tr>
<tr>
<td>At2: Feedback on Director's Short Script. 500+ words incisive, constructive feedback on the short 10-12 script. In addition, oral to feedback during tutorial sessions.</td>
<td>Due Week 9 and 10 - Written 15% Oral 5%</td>
</tr>
<tr>
<td>AT3: Interview with a Film and Television Industry practitioner focusing on their area of expertise. 1000 words reflection from the interview, and peer feedback around the audio recording of the interview.</td>
<td>Due week 11 20%</td>
</tr>
<tr>
<td>AT4: Industry Perspectives Blog - pass or fail mark based on completion. Constructive feedback is to be provided to two other peers on a weekly basis. Each blog submission will contribute to the final 10-12 short script of the screenwriting subject.</td>
<td>Weekly from week 1-13 – 40%</td>
</tr>
<tr>
<td>AT5: 15 min. group, in-class presentation on exploring a topic from screenwriting practices. Assessment based on the quality of the presentation and visuals.</td>
<td>Week 12 – 15%</td>
</tr>
<tr>
<td>AT6: 10-12-page short script. Should incorporate materials from blogs, tutorials, etc.</td>
<td>Week 13 – 50%</td>
</tr>
<tr>
<td>AT7: surprise quizzes and storytelling exercises.</td>
<td>30%</td>
</tr>
</tbody>
</table>

### Subject 1b

This subject is an elective in the Bachelor of Fine Arts in Film and Television and is complementary to Industry perspectives.

**Subject Overview**

Through a series of lectures, workshops, tutorials, and studio practice, students will be introduced to the basics creating stories for screen media, focusing on concept creation, screenplay structures, story and character generation. Students will study and practice the essential groundwork undertaken by writers in creating works for the screen and will learn how to apply these skills to their own ideas for screen projects.

**Learning Outcomes**

At the completion of this subject students should have acquired the following skills:

- Engaged at a basic level with contemporary screenwriting practices.
- Be familiar with the universal elements of compelling storytelling.
- Interrogated and critiqued screen texts.
- Begin to find their voice as a storyteller.
- Begin to practice clear, effective writing.
- Begin to lead/follow a project through from inception to completion.
- Begin to understand a process of researching, drafting, and redrafting documents to a polished outcome.
- Develop skills in creative collaboration.
7.1.3 What I think: individual beliefs

Before the PD program

As beliefs often may result from experience (Ertmer, 2005; Pajares, 1992), Leo reports that his beliefs and intentions were likely influenced by the connections he developed with his own lecturers, “I suppose the lecturers were really connected with and they responded positively to my work. And very quickly [...] That made me very focused on what they were saying. To the exclusion of everyone in the class to be honest” (initial interview). Leo also explained that those experiences drove him to help individual students nurture their desire to entertain people through television. So on a regular basis, Leo held tutorials with just three students at a time, which is a manifestation of his learning facilitation beliefs and intentions (Figure 7-2). There is also evidence to suggest teacher-centred tendencies which may derive from Leo’s discipline-specific expertise and professional training. Leo provided a rich illustration of this when asked to describe his pedagogical approach:

“I treated the classroom situation a bit like what we call the Story Room on a TV show [...] where you have a group of people around you and you gotta conduct them sort of like an orchestra in order to get their best, and out of themselves, and take the conversation in the right direction it needs to go to achieve your aims. So I’d master that particular part of being in a story room and getting the best out of people and maximizing what was good about their personalities and getting them to get with each other. And I just took that approach to the classroom [...] and it is my pedagogical approach at best” (initial interview).
In the story room approach, Leo seems to take on a more traditional role as the most active participant, “I feel like I am putting on a performance when I teach a class, and that performance allows me to be daggy and stupid in front of them [...] because it empowers everyone to think that they can be that too. They can take a risk creatively, you know, and to say something that they may not have ordinarily said” (initial interview). Leo’s beliefs about imparting information, motivating students, and genuine care for his students are direct precursors to his pedagogical because he believes that for creativity to surface: “fear has to leave the room” (initial interview).

**During the PD program**

To help Leo solidify his learning facilitation skills, it was important to get deeper insights into the nature of his beliefs. Leo strongly believed that his role was to motivate students and train them for their future careers (*Table 7-2*). For instance, he held interviews with industry professionals every Tuesday morning for all students and staff in the faculty to view.
Table 7.2 Case 1: self-reports of change in sub-components of the teacher beliefs and intentions questionnaire

Based on a Likert scale, with a maximum score of 10 except for facilitative teaching which amounts to a maximum of five points (Norton, et. al, 2005).

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<thead>
<tr>
<th>Learning facilitation</th>
<th>Beliefs</th>
<th>Intentions</th>
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<tr>
<td></td>
<td>Initial</td>
<td>Final</td>
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<tr>
<td>Problem solving</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>Interactive teaching</td>
<td>8</td>
<td>9</td>
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<tr>
<td>facilitative teaching</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>pastoral interest</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>motivator of students</td>
<td>8</td>
<td>10</td>
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<tr>
<th>Knowledge Transmission</th>
<th>Beliefs</th>
<th>Intentions</th>
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<tbody>
<tr>
<td>Training for specific jobs</td>
<td>7</td>
<td>9</td>
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<tr>
<td>Use of media</td>
<td>8</td>
<td>8</td>
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<tr>
<td>Imparting information</td>
<td>8</td>
<td>8</td>
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<tr>
<td>Knowledge of subject</td>
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</table>

Moreover, there seemed to be an association between Leo’s intentions to care for students (pastoral interest) and interactive teaching and his focus on motivation and training for jobs. This was evident in his open-door policy, the small tutorials he held with just three students at a time, and his extended but praiseful feedback strategy. In his own words, the intention is to “…free people up” (initial interview).

His tendencies for learning facilitation were also evident when asked to describe his epistemological beliefs, “students learn how to write by expressing their own life experiences on the page. They learn through experiences”. This reflects Leo’s understanding that creativity can only be facilitated, not taught.

**After the PD program**

Leo was asked to explain his understanding of the teacher and student-centred continuum,

“Student-centric teaching is putting them in the middle […] The learning outcomes are at the center of teacher’s focus. As a teacher, you are making sure you are totally focused on the delivery of the information in a way that they are receiving it in the way that you intend. Now, the opposite of that would be where it is all about you […] It’s more about putting it out there and hoping, well presuming they’ll get it […] Also, not sort of trying to think like your students
do, you know? Which is a different way of thinking. Not taking into account the levels of experience. And what's it like experiencing their own life experiences different than yours as a teacher. So not seeking to reflect. Being selfish, I guess. Very selfish as a teacher" (final interview).

Leo's reflection of student-centred tendencies conveys a focus on knowledge transmission while at the same time acknowledging the importance of students’ prior knowledge and experiences. His interpretation of teacher-centred could be summarized as not considering the needs of student, not trying new things, not reflecting on how students were learning. This suggests that there was little change evident in Leo’s teacher-centred beliefs and tendencies after his six-month participation in the PD program (Figure 7-2 and Table 7-2). In fact, during the final interview, Leo was asked to reflect on what he would recommend to a colleague struggling with a subject, based on his experience in the PD program, "I'll probably say, might be time to think about punching up your lectures in terms of the visual side of things, even a bit of a rethink about how you're delivering that" (final interview). His perception still emphasizes the role of the teacher as most active participant which is indicative of teacher-centred approaches.

An increase in teacher-centred orientations (Figure 7-2) may have been due to the efforts to stay on top of his subject expertise, "I practice what I preach, putting that in simple words. That's how I keep it alive. By always being very in touch with my own practice [...] I am jealous of anything that gets in the way of it. I resent it. Sometimes that is the students" (final interview).

There was a small increase in Leo's learning facilitation beliefs and intentions (Figure 7-2). During the class observation, even if a case-based learning approach was used, the discussion still focused on the teacher. When asked to reflect on the findings of his final diagnostic (Figure 7-2), Leo explained, “I think it's because I haven't actually yet implemented [...] the active learning stuff we've talked about.” (final interview).
7.1.4 What I know: competencies

Before the PD program

Leo expressed a lot of confidence in his technology related abilities, “There is a considerable area for growth in this school, full stop. I would be considered the one that is more technologically connected lecturers here” (initial interview). Note, however, that the findings from the initial diagnostic indicate low Technological Knowledge and high Pedagogical Knowledge (Figure 7-4). However, when requested to rate his confidence of Pedagogical Knowledge (Figure 7-3), Leo explained “I don’t know what half of these concepts even are. I’m up for learning new approaches to the task.” (initial diagnostic survey).

![Figure 7-3 Case 1: Self-reported changes to TPACK competencies, as measured by the TPACK assessment instrument by Schmidt et. al, (2009)](image-url)
During the PD program

As part of the PD program, pedagogical support focused on case-based learning, project-based learning, cooperation methods, peer instruction, and peer feedback. Leo was introduced to implementation strategies by watching videos of fellow teachers or by discussing how to enhance his lesson plans. Leo’s implementation of case-based learning was somewhat witnessed during the class observation. For example, during a lecture student were required to develop a pitch for a film of their choice. Interestingly, even if case-based learning promotes critical discussion amongst students, critical discussion occurred only with the teacher, the PPT slides were very stylishly presented, Leo was really funny, and managed to keep student’s attention throughout the class. Suggested improvements to Leo’s pedagogical strategies were noted and subsequently discussed with him.

In terms of Technological Pedagogical Knowledge, Leo was introduced to polling tools, mind mapping tools, digital storytelling tools, lecture capture, and enhanced uses of the LMS. When asked to reflect on how comfortable he was feeling with the new tools during the mid-program interview, he said, "I’ve yet to do that, but I will bring that in next semester. With a new unit so I can do that from the beginning, really
for all the lectures that happen next semester. That is my plan” (Mid Program interview).

**After the PD program**

The TPACK-based approach employed in the current study is Learning Technology by Design which focuses on the exploration of educational technology on the desired learning outcomes of the teacher's curriculum (For further information refer to Chapter 4). When asked to describe the influence of this approach on his teaching practice Leo responded,

“I don’t think my knowledge, in terms of what I’m planning, I don’t think that’s changed. But I think what has changed is just my awareness of how it can be delivered, or how it is being delivered. Both things. So I am seeing how it’s being perceived through delivery, I’m also seeing how it can be improved in delivery” (final interview).

Still, during the last interview, Leo reported “theory is not useful”. This statement is in direct contradiction with the self-reported efficacy in regards to Pedagogical Knowledge (figure 7-3). Note that Leo went from saying "I don't know what any of these are" (20%), to report 80% of confidence by the end of the PD program.

The most noticeable changes in this case study were found in technology-related TPACK sub-components (Figure 7-4). That means, a moderate increase in Technological Knowledge and Technological Pedagogical Knowledge, as well as a large increase in Technological Content Knowledge,

“I do feel very aware of the technological possibilities that I can bring into my teaching. So you’ve opened my mind to a lot of new things. But, you know, overlying that stuff that I can draw upon that can make the experience when I need it to be, better for my students” (final interview).
In practice, however, Leo’s Technological Pedagogical and/or Technological Content Knowledge was enhanced only in relation to the technological tools of Tumblr and Blackboard, which were part of his curriculum prior to the PD program. There was little uptake of any other educational technologies introduced to Leo due to a self-perceived lack of time to learn to use them.

“...additional technological stuff, all of which, there was nothing which I didn’t like the look of. But every one of them required me to make a time investment to actually go out and get it, to see, to really look at it and work out how it can, how it can be made practical and useful. So, I mean there’s nothing you showed me that I didn’t think, ‘oh that’s got application’. But most of them required me to actually like going into the program and to really sort of really master it. And what’s put me off so far has been the time commitment that requires. So that was the reality” (final interview).

These small changes are corroborated by an analysis using the Technology Integration Matrix. This analysis indicates a shift in AT1 from conventional uses towards more autonomous uses of technology by students (Figure 7-5). AT2 also reflects a shift from using technology as a tool to deliver curriculum, to using technology to facilitate higher order level thinking in a collaborative learning environment.

Figure 7-5 Case 1: Changes in the quality of technology integration based on the Technology Integration Matrix (Harmes, Welsh, Winkelman, 2016).
It was also evident throughout the implementation of the PD that any strategy, tool or change that would require time and effort met an obstacle given the complex lives of academics in which their need to do research effectively may compete with their teaching and learning activities. Leo was prompted to reflect on this,

“In terms of trying to keep my students at the center of things as much as I can. Certainly, it’s in the forefront of my desire when teaching. But I am wise to the pressures that are on us as teachers. And a lot of it is not about the students, you know? This is the reality of being in University. At times you get the feeling they’re secondary to the University’s own focus. Now, most of us try for that to not be the case. Certainly here. There’s a strong commitment to teaching and to the students. But the realities are, those are not the things that we’re necessarily judged on as academics here. And there is a lot of pressure.” (final interview).

7.1.5 What I do: teaching practice

Before the PD program

Insufficient Pedagogical Knowledge was reflected in Leo’s initial learning designs (Figure 7-6). The was determined by an analysis of Leo’s perceptions of his own knowledge as reported in the interviews, confidence logs, the findings from the TPACK and Pedagogical beliefs assessment instrument, as well as the document analysis. The curriculum for both subjects could be considered project-based, but there were opportunities to improve the tasks with clearer instructions, collaboration, marking rubrics and peer feedback. Leo also reports high self confidence in his competencies to brainstorm, understand, and use active learning tasks, but low confidence in his abilities to implement those designs (Figure 7-7). Interestingly, when asked to reflect on these findings, Leo focused on how organizational culture was sometimes a constraint performing in his role,

“The thing that has come to bear on me, and no doubt all of here as academics is the political realities of the university. That we have to be really mindful of. So, we got a lot of pressure on us to deliver research outputs. And the biggest thing that gets in the way of delivering that as an academic is the students. Ironic, but that is the truth of it [...] I realized that I really had to
put a lot more of my time a week into that side of academic life, in order to keep everyone happy” (initial interview).

Figure 7-6 Case 1: Changes in the quality of fit in learning designs measured by the Technology Integration Assessment (TIA) Rubric (J. Harris et al., 2010)

Figure 7-7 Case 1: changes in self-efficacy in regards to competences over the course of a semester
During the PD program

To begin the PD program, the assessment tasks (AT) for subject 1a and 1b were collaboratively redesigned. For instance, AT3 (Table 7-1) required students to identify and interview an industry professional. Prior to the PD program, the interview was a poorly structured alternative to writing an essay. So, Leo was supported to redesign the activity which required students to upload a recording of the interview with an industry professional so that peers could provide feedback on it, before they wrote an essay reflecting on the content of the interview. The students really valued the task:

“Things like the interview .... It was a good use of technology all around both for them (students) and for me” (Leo, final interview).

“I felt like it was a necessary experience because at some point we have to go into the industry ourselves and network with people who are actually working in the industry. So in a way, I felt like it was a good experience” (student 6, focus group).

AT4, the weekly blogs are another interesting instance of TPACK enacted in practice. At the beginning of the PD program, the participant explained,

“The blogs are a baptism by fire for first-year students and they may fall by the wayside with blogs. And the thing that trips them up is the idea of having to do it weekly. Those who rise to the challenge, which usually is 75% of the class, can manage it, they get an enormous amount of the fact that they have something short and sharp every week. So I think, we should talk frankly about blogs, right? [...] when universities cut back on staff, which they have done a lot, and put more admin responsibilities onto lecturers. Lecturers have to come up with ways of getting students to do a fair bit of work without being quite so onerous because the time just wasn’t there anymore” (initial interview).

Note how the Leo’s perceptions of organizational culture has influenced his attitudes towards the task. During the design consultations, Leo’s beliefs were challenged by discussing the benefits of adding a peer feedback strategy to enhance learning and streamline the marking process. The task was
redeveloped to allocate a small percentage of the grade for peer feedback, as well as specific questions with the aim of coaching students on how to provide constructive, quality peer responses. Mid-way through the semester, Leo felt more confident and changed his attitude towards the task. The students confirmed their satisfaction with the task,

“I did enjoy being motivated to writing and submitting stuff on a weekly basis [...] So, I thought the blogs were a good aspect of the course” (Student 1, focus group).

“I really liked that part where we had to comment on three other people’s blog, each week [...] I feel we all sort of had a fairly good idea early on of what everyone’s writing, and what they were interested in” (Student 3, focus group).

Moreover, one of the most valued updates to the instructional materials regarded the creation of marking rubrics. Mid-way through the program, Leo started to report the perceived benefits,

“So it is a way for them (students) to sort of pinpoint exactly what is required for the assignment, and that hasn’t existed quite so clearly before that rubric came in, so this is for the screenplay assignments. Um, I am finding that that is really good. Because one of the problems with assessing creative writing work is, actually, the lack of detail. Because it is not scientific, it is not factual, it’s just very much what is produced as a creative work. So in actually being able to put something almost of a scientific overlay, or at least a technical overlay, and say we want this, [...] these things must be achieved in the assignment [...] it is going to make marking much easier” (mid-way program interview).

After the updates to the instructional materials were finalized, design consultations focused on supporting Leo’s abilities to successfully implement them. In fact, growth in Leo’s Pedagogical Knowledge resulted in an altered approach to feedback. Initially, Leo noted his feedback strategy was learned from previous mentors in the industry,

“I continue my approach which is diplomacy and careful praising and really looking at the way in which bad news are delivered in a way that is not destroying. I often can find that they (students) can get intolerant of that approach. Not all of them say that, but some of them say: ‘I don’t believe what you are saying’. And they start questioning whether my more political phrasing is the truth...” (initial interview).
To support Leo, one of the design consultations focused on modelling epistemic and suggestive feedback strategies based on the work of John Hattie and Timperley (2007). Another suggestion was to use voice recorded feedback. Leo experimented with the use of voice recorded feedback but the content of his feedback was still based on his strategy of careful praise. This elicited the following comments from students:

“\[\text{I was confused after I got my feedback, why I got the mark I got. Because the feedback was really positive and I lost eight marks on it [...] And there wasn’t enough critique in there to justify that mark. Like I wanted to know what he put me back for so I could learn from it, and you definitely don’t learn much from someone just saying ‘you did great, you did really great!’}\]

(Student 5, focus group).

“\[\text{...Since he has had such a long career, being a screenwriter himself and working as a screen producer, he’s read a lot of scripts and he knows what is good and what is bad. So, um, sometimes I felt like he wasn’t being completely honest with the feedback}\]

(student 1, focus group).

Upon reading the students’ feedback (data was decoded to abide by ethics standards), Leo was upset. As a result, during the last month of the PD program, he actively experimented with more direct epistemic and suggestive feedback. By the end of the PD program he reported,

“So the extra feedback from what you did with the students, that was really useful. Even though I could have killed them [...] now, I just give it to them [direct feedback]” (final interview).

**After the Program**

Leo perceived the influence of the PD program on his teaching practice in the following way,

“So the changes I have grown in, have been all about enhancing their [students’] learning, improving their experience” (final interview).
The PD program resulted in an increase in Leo's self-efficacy, slight changes to TPACK competencies and pedagogical beliefs. In practice, small visible changes were evident in the learning designs which reflected an increase in pedagogical competencies with small improvements to his technological setup, especially with regards to two out of four primary tasks in his curriculum.

Leo's plans for the subjects included: improving LMS configuration throughout the rest of his subjects based on his experience with the PD; decrease the amount of screen time and increasing the time for general discussion during lectures; continuing the use of rubrics and interview assignments and using QuickTime to record his lecturers to make them available for later review.

7.1.6 Case 1 discussion

There is evidence to suggest that Leo's pedagogical beliefs are in a transition being influenced by his own interaction with students, his discipline-specific knowledge, and his own teaching experiences. This analysis aligns Leo's teaching practice to David Kember (1997)'s conceptions of teaching continuum. Leo started the PD program in the transmitting structured knowledge stage influenced by his "story room" approach, he perceived himself as an orchestrator, transferring well-structured content to students. By the end of the PD program, there is evidence of the teacher-student interaction stage characterized by teaching as an interactive process where students are active participants who discover their own knowledge.

There wasn't that much change in regards to Leo's use of educational technology; however, it should be noted that this was the pilot case study. After a detailed evaluation of this iteration of the PD program, it was realized that the approach to technological support needed to be updated. In this iteration, only one design consultation was devoted to introducing Leo to a range of technological tools, but no practice time or continuous support was provided. During this one session with technology, Leo seemed overwhelmed with the amount of information. This
resulted in no integration of any new technological tools. There was an enhanced use of the LMS and Tumblr in tasks, but these were tools that were adopted by Leo prior to his involvement in the PD program.

It can also be argued that Leo’s value system was influenced by inadequate technological support. Leo’s motivation to “streamline things” related to the commodity of time which is considered the cost of engagement in this PD program. Because Leo was overwhelmed with information, he did not find value in investing time to learn to use more technological tools to enhance the curriculum beyond its original state. This is relevant in this case given that organizational culture was often reported to present time constraints due to the demands of his academic role.

It also seems that Leo’s pedagogical beliefs have a greater influence in his actual teaching practice than his Pedagogical Knowledge. It is argued that awareness or knowledge did not seem to directly translate into practice unless Leo was supported to implement the suggested strategies successfully. Prior to his involvement in the PD program, Leo had little awareness of learning theory. However, he had strong epistemological beliefs as a result of professional experiences. This led Leo to design a 10-12 short script assessment task based on project-based learning, even if he had no knowledge of the strategy he was using. Leo also had strong beliefs in his pedagogical strategy of the “story room’. Due to his interest in increasing facilitative and interactive teaching, he was supported to learn about case-based learning. However, in practice, his lectures continued to be based on his ‘story room’ approach which reflects well-structured knowledge transmission, rather than on critical discussion of cases amongst peers.

In addition, Leo started the PD program with a strong belief that diplomatic criticism or praise was needed to help students’ creativity to blossom. He was made aware of the possible limitations of that strategy and was supported to learn about
epistemic/suggestive feedback. Still, Leo continued to praise students until feedback from the focus group made him change his approach. Thus, it seems that increased Pedagogical Knowledge does not directly result in enhanced teaching practice.

7.1.7 Improvements to the PD program after the first iteration

As discussed in chapter 6, the current study follows the guidelines of Design Based Research (DBR) methodology, which is particular due to its iterative nature. DBR guides the researcher to engage in an in-depth formative and summative evaluation of the PD program throughout a semester long implementation. Such evaluation helps to identify improvement areas and enabled constant refinement of the PD approach before the next implementation.

The first improvement to the PD program related to the recruitment strategy. Initially, the recruitment of potential participants involved sending an email to the head of teaching and learning of each faculty requesting their help to identify teaching staff members. This strategy may have been perceived as a ‘top-down’ attempt to manage performance because only two expressions of interest were received, despite the dozens of individuals that were invited to participate. Consequently, in preparation for the second iteration of the PD program, an advertisement was posted in the staff newsletter requesting potential participants to send their expressions of interest via email. This improvement made the strategy completely confidential and voluntary.

It was also recognised that during the design consultations, too much time was spent on analysing and discussing pedagogical approaches and learning designs, leaving insufficient time to discuss ways to enhance the integration of relevant technological tools. Initially, only one design consultation was dedicated to creating awareness in participants of the technological possibilities available; however, this session proved to be ineffective as participants reported feeling overwhelmed, resulting in little improvement to technological competencies. The PD program was refined to
allocate ten minutes of each design consultation to discuss technological tools that were relevant to the participant's curriculum.

The use of the website created for the PD program also required improvements. Initially, participants were sent a request to prepare for each design consultation which included a link to a section on the website about the relevant pedagogical approach for that specific session. This strategy proved to be ineffective as the participants did prepare. The improvement involved allocating time to discuss content and pedagogical tips found on the website. In this way, even if participants did not prepare for the consultations, they were still aware of the relevant learning theory for that session.

Finally, the collaborative, summative evaluation of the participant's subject also required an improvement. Initially, too much time was allocated to discuss LMS statistics and feedback from students. This session was refined by integrating the learning design visualizations, so participants could compare and discuss the effectiveness of the changes applied to their assessment tasks.
7.2 Case Study 2 – Analysis of Findings

7.2.1 Participant description

Hillary has over ten years of teaching experience with both blended and fully online subjects. She is a medical doctor who specializes in sexually transmitted infections. At the time of her participation in this PD program, she was a part-time lecturer doing three days of teaching, and two days of clinical work. Her teaching career began during her early clinical practice when she volunteered her time to have informal talks with clinical students. After she was appointed as a part-time lecturer in 2007, she did a Graduate Certificate of University Teaching program. But she indicated this was the only teaching-related training she had been exposed to. The only ongoing support was provided by the central LMS team at the University, and even if it was very informative and valuable, it was limited and sporadic.

Due to an increase in her teaching load and administrative duties, Hillary was interested in transferring all of her subjects into a fully online context. As a result, this is a year-long case study, with design consultations taking place once a month instead of biweekly. Data was collected during the blended delivery of the subject which took place in the second semester of 2017. The motivation behind this participant’s involvement in this PD program was expressed as follows,

“I would like students to feel involved and actively participate when a subject is run online totally and I’m not sure I’m achieving this. I would like help with some ideas for this and for increased use of technology in my teaching” (Initial Assessment instrument).

7.2.2 About the subject

Subject 2 is part of a Master in Public Health. The main objective of the subject is to introduce students to diagnostic procedures and treatments for a range of sexually transmitted illnesses. There are approximately 30 students in the cohort. The instructional approach follows the guidelines of case-based learning, there are two main assessment tasks and no final examination. The subject runs for twelve weeks
with one lecture a week delivered by practitioners and researchers in the field. Often in class demonstrations focus on using equipment to diagnose an STI, but labs are not part of the subject.

Table 7-3 below includes a description of the subject’s objectives and tasks. The learning design of the subject is displayed in Figure 7-8 and is colour coded. The solid yellow boxes highlight the sequence of PD activities throughout the semester. Blue boxes depict a directed, lecture mode of delivery with expert guest lecturers in yellow. The ovals represent the inquiry-based assessment tasks. The delta symbol in yellow draws attention to changes as a result of the PD program and will be found throughout the text to highlight the nature of the influence of the PD program in the participant’s teaching practice.
Figure 7-8 case 2 learning design subject 2 including a map of the sequence and influence of the PD program in the participant’s teaching practice.
Table 7.3 Case 2: Subject and Task Descriptions

<table>
<thead>
<tr>
<th>Subject 2</th>
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<td>This subject is an elective of the Masters of Public Health</td>
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**Subject Overview**

This subject will address the basic epidemiology, diagnosis, and management of common sexually transmissible infections (STIs). It will address the basic principles of STI control and discuss the major influences and factors affecting this control in different settings. This subject will demonstrate and explore the most important public health and clinical consequences of STIs.

**Learning Outcomes**

At the end of this subject, students are expected to be able to:

- Demonstrate their knowledge of epidemiology, diagnosis, and management of sexually transmissible infections.
- Demonstrate their knowledge of public health implications of STIs.
- Critically appraise the factors on the epidemiology of STIs in different settings.
- Reflect upon and analyse the barriers to effective control of STIs.
- Reflect upon and analyse the role of sexual networks, clinical services, partner notification, and sex workers in determining the prevalence of an STI.
- Reflect upon and interpret from the literature the interaction between HIV and STI in the spread of HIV.

<table>
<thead>
<tr>
<th>Assessment Task (AT) Description</th>
<th>Timing and grade %</th>
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<tr>
<td>AT1: Students address four out of five case scenarios pertaining to relevant topics in the curriculum. 500 words per answer.</td>
<td>Due week 5 - 40%</td>
</tr>
<tr>
<td>AT2: 2000-word expression of interest to get funding from the government to establish an initiative aimed at controlling the spread of STIs in the local community.</td>
<td>Due week 12 - 40%</td>
</tr>
<tr>
<td>AT3: 1000-word peer feedback response to a peer's AT2.</td>
<td>Due week 13 20%</td>
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</table>
7.2.3 What I think: individual beliefs

Before the PD program

Hillary’s medical education was based on problem and case-based learning which may have influenced her pedagogical beliefs. She was highly aware of how teaching and learning strategies had affected her own learning as a student and was very vocal about how dissatisfying her university experience had been. She reported, “It was all about the lecturers’ lecture, rather than what you learned. Clearly opposite to what we are meant to be teaching now” (initial interview).

When prompted to reflect on the results from the initial assessment instrument (Figure 7-9), Hillary explained,

“I think I have had a shift when I did the Graduate Certificate in University Teaching [...] probably not enough, but I was completely the other way before (teacher-centred). I did then understand the difference between students learning and me teaching, which I never really thought about before, I must admit and that was like eight years ago. But I probably gradually shift back, yes, I probably think I do […] And I think that comes from wanting to take responsibility for the teaching more than the learning, because you feel like you are assessed and evaluated by the students and if you leave it up to them, I fear it won’t be as good as if it were teacher focused” (initial interview).
During the PD program

It was evident that Hillary often tried to replicate the case and problem-based learning approach of her medical education, but her actual practice was highly focused on knowledge transmission. To support Hillary's ability to align her beliefs to her practice, she was asked to think about how case-based learning was implemented by her own teachers. She reflected, “it would often be around a bed with a patient, but it would always be very inclusive, you'd feel comfortable asking questions [...] very much related to the work we were doing in hospitals” (mid-way program interview). These experiences were found to fuel her epistemological beliefs,

"I think I learned (and I think this is how students should learn) from a very problem-based or experimental approach. I acknowledge and I see that is the best way to learn [...] making sure that they are thinking critically, I suppose, it is. I mean, that all sounds like buzzwords, but it is really about engaging them deeply, so they don't just sit there and go to sleep while I give them a lecture and write down the answers" (mid-way program interview).

Figure 7-9 Case 2: Self-reported changes in pedagogical beliefs as measured by the diagnostic instrument by Norton et al., (2005).
Hillary also continued to express a lingering concern over her teaching, administrative and medical responsibilities.

“I think a lot of teachers feel like this [...] there is no admin support these days, so I think the concerns, worries, anxieties and hard work for me is not the actual teaching content, but building the stuff behind it and I just don't know. I have nobody to do it for me” (mid-program interview).

To address these concerns some of the conversations explored sources of support. This resulted in Hillary applying for funding to enhance her subjects. She also contacted two more subject matter experts to help with the teaching and marking loads.

**After the PD program**

At the end of the PD program, when asked to reflect on how her teaching practice aligned to the continuum of teaching conceptions, Hillary explained,

“I think it has been a gradual thing over the years, where I was taught it was the sage on the stage as they say, and I did go into teaching thinking, and then we had all the new stuff which was about problem-solving stuff and it wasn’t about somebody knowing all the information. I sort of think I swung back a bit, and I think I have eventually found my own way, which is a middle path between being content expert but still thinking it’s about them and their learning, rather than about what I’m going to do for them” (final interview).

Hillary’s perception of her own teaching practice acknowledges both teacher and student-centred tendencies. This is aligned with the findings from the assessment instrument which indicate some changes over time. For example, there is a moderate decrease in her endorsement of beliefs and a large increase in the scale of intentions towards learning facilitation (**Figure 7-9**). Yet, there is a moderate decrease in her endorsement of beliefs and a similarly moderate increase towards knowledge transmission intentions. While this may seem contradictory, there are two factors to
consider. The first is that upon seeing the findings from the diagnostic survey, Hillary said,

"I don’t think this is accurate (initial findings), yeah, because, I think this is more accurate (final findings) [...] With this (initial findings), I think the problem is you don’t know how you much know until you do this (PD program). I think maybe I had no idea how much I knew really at the beginning" (final interview).

These observations highlight an overestimation of her own abilities due to a lack of knowledge. Another factor to consider is the nature of the reported changes. Note that beliefs and intentions towards problem-solving, facilitative teaching and pastoral teaching remained the same (Table 7-4). In addition, beliefs about interactive teaching slightly decreased while intentions slightly increased. This contradicts Hillary’s self-reports through interviews, learning designs, class observation and student focus group, which reflect a strong tendency towards interactive teaching.

Table 7.4 Case 2: Self-reports of change in sub-components of the teaching and beliefs intentions questionnaire

Based on a Likert scale, with a maximum score of 10 except for facilitative teaching which amounts to a maximum of five points (Norton, et. al. 2005)

<table>
<thead>
<tr>
<th>Learning facilitation</th>
<th>Beliefs</th>
<th>Intentions</th>
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<tbody>
<tr>
<td></td>
<td>Initial</td>
<td>Final</td>
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<tr>
<td>Problem solving</td>
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<tr>
<td>Interactive teaching</td>
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<td>facilitative teaching</td>
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<td>pastoral interest</td>
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<td>motivator of students</td>
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<td>Training for specific jobs</td>
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<td>Use of media</td>
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<td>Imparting information</td>
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</tr>
<tr>
<td>Knowledge Transmission</td>
<td>Knowledge of subject</td>
<td>9</td>
</tr>
</tbody>
</table>

In addition, the elements of training for jobs and knowledge of subject slightly decreased for both beliefs and intentions (Table 7-4). Knowledge transmission and use
of media beliefs changed slightly while intentions for both slightly increased. Hillary explained,

“...I always have this fear about not giving them enough content. I still have that fear, but I think maybe that fear is less because I realize that content is less important than I used to think it was. Instead of me giving them the content, I am aware that I need to help them find the content in other places, rather than from me. To think critically, I suppose [...] before I was thinking about how I can give them all this knowledge that I’ve got, and just dump it there, whereas now I’m thinking about how I can get some of this stuff across to them in a different way rather than just giving it to them all” (final interview).

7.2.4 What I know: TPACK competencies

Before the PD program

Due to her extended professional experience, Hillary reported high content knowledge but less certainty about her pedagogical abilities (Figure 7-10).

"It all has to do with time, and I don’t have time to do that as much as I would like to. I feel like I have a really good knowledge of what I should be doing, I don’t always feel like I do that. Because I don’t have the time to do that sometimes" (initial interview).

Figure 7-10 Case 2: Self-reported changes in TPACK competences as measured by the TPACK assessment instrument by Schmidt et. al, (2009)
In terms of Technological Knowledge, Hillary said,

“I feel a lot of the students don’t feel comfortable with technology. And they are like me and I think ‘Oh, my God! You must know better than I do because you are 30 years younger than I am.’ So sometimes [...] some of them have challenges then I feel like, ‘God it is me helping them, it is like the blind leading the blind’” (initial interview).

This reports correlate with the self-reported efficacy in terms of using cognitive tools (Figure 7-11). However, Hillary does report low self-efficacy related to assessing and designing active learning tasks (Figure 7-11) which somewhat contradict previous reports on Pedagogical Knowledge (Figure 7-10).

![Figure 7-11 Self-reported changes to confidence in regards to competences over the course of a semester](image)

### 7.2.5 During the PD program

To support Hillary’s Technological Pedagogical and Technological Content Knowledge, the PD strategies aimed at enhancing her awareness of learning theory and technological tools. More specifically, the agreed strategic improvements to the curriculum included: engagement strategies through chats, polling systems, or mind map; hands-on practice sessions on how to deliver a flipped webinar; using available
learning analytics for formative and summative evaluation of subjects; and enhancing Hillary’s abilities to use the institutional LMS. Discussions on pedagogy focused on the flipped classroom, peer instruction, and case-based learning.

Another aspect of Hillary’s pedagogical beliefs that could be usefully challenging was her attitude towards online feedback strategies,

*When I used *PRAZE I found it was a complete nightmare because I had a little bit of support from the PRAZE and LMS teams. I met them a couple of times, but the whole process was so time-consuming and got me completely overwhelmed with work and I think probably because I wasn’t using it properly. I don’t know but I had so much more marking and so much more evaluation and feedback that I had to give. Then it put me off wanting to do those things again” (mid-way program interview).

The pedagogical support provided in the PD program included strategies such as allocating a percentage of the grade for peer feedback, creating marking rubric for students to use as reference, coaching and modelling constructive feedback in class, as well as using *TurnItIn PeerMark as a technological tool. In addition, an evaluation session was held with Hillary after the AT1 submission to provide suggestions to automate the marking process.

*PRAZE and TurnItIn PeerMark are technological tools that allow teachers to set peer review assignments and are readily available in the Learning Management System of the University.

After the PD program

In terms of TPACK competencies, the findings reflect a large change in Technological Knowledge, with Technological Content Knowledge and Technological Pedagogical Knowledge being reported as unchanged (Figure 7-10). This is consistent with the interviews, in which the participant reported an increase in abilities to select and use technological tools but was anxious about her abilities.
"That [Technological Knowledge] would be one thing I'd definitely say I've changed a lot on [...] I don't know if I can do it, but I know about it. Well, things to use on the LMS, technological methods to engage students and ideas on how to do that [...] I suppose I know how to do that, it's just I feel now I will be doing that. So, I don't think the knowledge of it has changed, but now I know how to do it" (final interview).

However, an analysis using the Technology Integration Matrix reported no change in the quality of technology integration in the tasks. Changes in Hillary’s teaching practice relate to self-efficacy, with only some modest improvements to her technological setup (Figure 7-12).

Pedagogical Content Knowledge and Pedagogical Technological Knowledge remained unchanged. This is in contrast to the increased self-reported confidence in knowledge of learning theory and pedagogical tools (Figure 7-11). Notice how there was a large change in self-efficacy reported in the confidence logs related to reviewing objectives in assessment tasks, applying constructive alignment, brainstorming, understanding,
designing, implementing active learning, selecting and using educational technology tools.

7.2.6 What I do: teaching practice

Before the PD program

Hillary’s Pedagogical and Technological knowledge was reflected in her learning designs (Figure 7-13). Even though her tasks were based on critical questions, the designs had unclear instructions, no marking rubric, and did not include any peer-to-peer type of interactions. In fact, at the beginning of the PD program, Hillary did not even know what a marking rubric was. She commented, “I am going to ask a really stupid question, what is a rubric? Is it a guideline?” (initial interview). This affected the quality of fit in her learning designs.

![Figure 7-13 Case 2: changes in the quality of fit measured by the Technology Integration Assessment (TIA) Rubric](image-url)
During the PD program

Design consultations to support Hillary’s Technological Knowledge and Pedagogical Knowledge through the collaborative redesign of her tasks occurred during the first semester of 2017. The second semester of 2017 concentrated on supporting the implementation of her subject.

The first change involved updating her subject outline to include a map of lectures and invited speakers for the semester. The structure followed the guidelines of the subject outline as communication device which focuses on clarifying how to contact lecturers for support, resources and supports available, as well as outline specifications for students on how to prepare for every lecture (Lund Dean and Fornaciari, 2014).

Then assessment task 1 (AT1, Table 7-3) guidelines were redesigned around case-based learning. Authentic life scenarios were developed and real reports on the state of HIV in Africa were included through websites, videos, and images. A formative feedback strategy was included prior to the final submission.

AT2’s guidelines were also updated to include a peer feedback strategy and the task required students to reference state government websites and graphs for authentic data. This resulted in a change in the quality of the design of both assessment tasks, which resulted in moderate levels of “fit” (Figure 7-13). Detailed marking rubrics were also developed for both tasks.

The most noticeable influences of the PD program on Hillary’s teaching practice was her confidence and willingness to relinquish control. In fact, Hillary increased the number of expert guest lecturers as a method to facilitate learning,
as well as to motivate and prepare students for their future careers as medical practitioners. These efforts were greatly appreciated by students who reported,

"This is something I really appreciate about the subject. So not only are we getting experts in the field. But you do see lots of like little references around it." (Student 4, focus group).

"Pretty much every lecture is an expert, there has been reinforcement of stuff I had already learned before and maybe a little on top. It has just helped me progress my understanding of the whole field" (Student 5, focus group).

**After the PD program**

Hillary described the influence of the PD program on her teaching competencies,

“I think I have moved from the sage to a facilitator. So, it is more about the implementation [...] What to implement and where in order to engage students and increase learning” (final interview).

Discussions of formative assessment and evaluation resulted in visible changes to Hillary’s understanding of marking rubrics and formative feedback. By the end of the PD program, she had already developed more marking rubrics for her upcoming fully online subjects. Moreover, her attitude towards peer feedback strategy changed,

"This (PD program) gave me more confidence that what we were doing was correct [...] I think there are some things that we have tweaked and that we’ve discussed that we’ve made hugely better. For example, the short answer questions, personalizing those and making them like cases. Also tweaking the peer review, I think that has made them much more, as I say, educationally sound just with tiny little bits in there" (final interview).

Another underlying theme in the collaboration with Hillary was the self-reported perception of the impact of organizational culture on her teaching practice. Organizational culture was often reported as a limitation which imposed additional
administrative responsibilities and lack of support. In this case, however, there were no reports of pressures to publish. Nevertheless, the analysis provides insights as to how organizational culture can affect the peer-to-peer collaboration within a faculty or department. For instance, when asked to describe the advice she would give a colleague struggling with a subject she responded,

“No, because I don’t think many people acknowledge that they have a difficulty. My subjects would be within the school of population and health; I don’t think people acknowledge that they have a difficulty. Whether they have insight into the fact that they’re having difficulties, I don’t think it’s made public” (final interview).

There is evidence to suggest that Hillary’s organizational culture can be defined as a low consensus institution characterized by lack of collaboration. When asked to describe the type of PD she thought would be ideal for her practice, the participant explained,

“We talk about peer review in the school, and to be honest they sort of say, ‘yeah, that was a good session’. That is all you get. I don’t think that sort of peer review is particularly useful. I would like to have a peer review with an expert who knows more about pedagogy and about constructive alignment. That is what I felt I was missing […] I don’t want to sit down with colleagues at the school because I don’t think most of them have got less experience than I have. They understand less than I do about teaching. I felt I had nothing really to learn from those people. This (PD program) has been really, really helpful because this is exactly what I wanted” (final interview).

Finally, Hillary’s plan for the subject was to continue peer review strategies, use of rubrics, run webinars with Zoom and increase communication channels through Google Hangouts and/or WhatsApp.

7.2.7 Case 2 discussion

This analysis enables the alignment of Hillary’s teaching practice to Kember (1997)’s teaching conceptions continuum. There is evidence to suggest that Hillary started the
PD program in the transmitting structured knowledge stage. In this stage, students where often passive recipients, and Hillary felt overwhelmed with the lack of support to structure her materials. By the end of the PD program, Hillary transitioned into the teacher-student interactions stage where she seemed to feel more like a tutor and presenter of an interactive process where knowledge is discovered by students.

This case study is part of the first iteration of the PD program, but given that it is a year-long study, updates to the approach to technological PD highlighted by case 1 were able to be implemented during the second semester of 2017. The PD program appears to have significantly influence Hillary’s pedagogical beliefs and self-efficacy. Pedagogical and Technological Knowledge and confidence in regards to technology use increased but only slightly.

Hillary reported that the collaborative discussions on learning theory and uses of technology based on her curricular tasks, along with the reflection on the class observation, confirmed that her pedagogical approach was not only appropriate for her discipline, but also evidence-based. This seemed to have enabled Hillary to recognize the value of investing time and effort into improving her subject, to the extent that she was motivated to request funding to support the transfer of her subjects into a fully online mode. Hillary’s self-efficacy was also influenced, as she seemed to overcome her initial frustrations with a lack of support. This resulted in increased tendencies towards more interactive teaching focused on critical thinking and case-based learning. There was also an enhanced use of technology for visual representations and to facilitate peer feedback strategies.

Another interesting result of this reflective PD approach is the awareness of her own fear and need to control the outcome of student evaluation of her performance. Such awareness allowed Hillary to find the confidence to relinquish control by increasing the
number of expert guest speakers and creating more spaces for critical discussion. This in turn resulted in reports of increased self-efficacy in Hillary's own abilities to better respond to the demands of her role.

A slight improvement in technological competences was observed in terms of use of the LMS, engagement strategies, as well as an increased awareness of learning analytics for summative evaluation of her subjects. But perhaps due to a lack of appropriate support during the first semester of the PD program, Hillary still felt anxious about her uses of technology. The PD program helped her to create solid plans to increase the use of educational technology to enhance student engagement, given that most of her subjects were to be delivered in a fully online mode.

This case study shows how pedagogical beliefs are shaped by previous learning experiences and that they are different from Pedagogical Knowledge (Bai and Ertmer, 2008; Kim et al., 2013). In fact, this case supports the argument that pedagogical beliefs may have a stronger influence on teaching practice than Pedagogical Knowledge. Consider Hillary's initial lack of knowledge of the theory of case-based learning prior to the PD program. Even if her attempts were often poorly structured, in practice she tried to replicate the case-based learning approach from her own medical education. Her practice was based on a belief that critical thinking on cases was valuable to her discipline. Such beliefs resulted from her own experiences, rather than from specific PD.

This case study also provides evidence to suggest that institutional expectations and the need to control learning outcomes may act as enablers for teacher-centred approaches. This participant had over ten years of experience and her teaching at the time she started this PD program still seemed to be centred on knowledge transmission tendencies, therefore, it seems that teacher-centred approaches are not dependent on
teaching experience. Rather, it suggests that inadequate pedagogical training, competences, and constraints in organizational culture, present limitations to more student-centred approaches. Interestingly, this case also provides insight as to how organizational culture may be a frequent barrier to willingness to collaborate amongst peers.

Insights into how findings may be affected by self-reports or over reliance of assessment instruments was also found. Consider how Hillary admitted she had rated herself higher in the initial diagnostic survey due to a superficial understanding of learning theory. A mixed methods methodology made it possible to determine how these self-reports aligned with the changes from the diagnostic survey with confidence logs and interviews.

7.2.8 Improvements to the PD program after case 2

As a result of the implementation of this case study, it was identified that the approach to the development of technological abilities was still inadequate. The ten minutes of each design consultation allocated to discussing relevant technological tools resulted in increased awareness, but that knowledge was not always manifested in enhanced uses of technology. As a result, this strategy was refined to concentrate time and efforts on one or two relevant technological tools. This allowed to allocate time for hands-on practice activities for teachers to prepare tasks using those tools.

The class observation was also reported to be a really powerful tool to entice reflection, but initially, the reflection session did not focus on discussing pedagogical beliefs. This session was refined to begin with a summary of participant’s pedagogical beliefs from the previous interviews.
It also became clear that participants in charge of fully online subjects required knowledge and competencies to be able to implement webinars. Therefore, a design consultation was devoted to hands-on-practice exercise around webinars using ZOOM as a video conferencing system.
7.3 Case 3 – Analysis of Findings

7.3.1 Participant description

Delia has over seven years of experience teaching and some experience working at an architecture firm. She is not very confident about her professional experience given that it has been more than a decade since she last worked in the field. She is a researcher in the area of Urban Planning and Design. At the time of her participation in the PD program, she had just been appointed as a full-time academic whose work responsibilities were divided into six months of full-time teaching, and six months of full-time research.

She began her teaching career in 2010 at a university in Queensland. However, lack of exposure to professional development and support made Delia particularly anxious about her own teaching practice,

“I've been teaching Urban Design for six or seven years. The first time I improved [the curriculum of the subject], I had really good SES scores. Then suddenly two years down the line, it became really bad. But it was the same materials, the same approach, I don't know what happened...So I am kind of a bit scared because this might happen again.” (initial interview).

Having just been hired at a new institution, she was overly anxious about her abilities. She expressed her motivation to participate in this PD program as,

“*What motivated me to take the opportunity [is] to see or try to improve my teaching, because I don't want to have very low SES results [...] Having someone to look at how I teach, and how I encourage students to learn from an outside perspective. I [want to] understand how I teach. What kind of improvement I could do with it to actually have that consistency in terms of how satisfied students are*” (initial interview).
Subject 3 is an elective subject of the Master degree in Urban Planning and Design. The main objective of the subject is for students to analyse the links between urban policy and health risk factors such as physical activity, diets, social interaction, and air quality. The subject introduces students to how urban planning, design, and policy contribute to creating healthier communities.

There are over 30 students in the cohort and the curriculum follows a case-based learning approach with three assessment tasks. The subject runs for twelve weeks, requiring students to attend one 1.5-hour lecture and a 1.5-tutorial. Delia organizes invited speakers to participate in her lectures. A tutor is in charge of the tutorials which aim to provide students with hands-on practice through collaborative group work, role plays, and discussion.

*Table 7-5* below includes a description of the subject's objectives and tasks. The learning design of the subject is displayed in *Figure 7-14* and is colour coded. Solid yellow boxes represent the PD activities that took place throughout the semester. The blue boxes represent lectures while the tutorials are outlined in yellow. The ovals describe inquiry-based/experiential assessment tasks. Note that throughout this analysis the delta symbol in yellow draws attention to changes the learning design as a result of the PD program.
Figure 7-14 Case 3: Learning Design Subject 3 including a map of the sequence and influence of the PD program in the participant’s teaching practice.
Table 7.5 Case 3: Subject and task descriptions

Subject 3

This subject is an elective of the Master’s degree in the School of Design

Subject Overview
This subject explores the links between urban policy and health risk factors such as physical activities, diets, social interaction and air quality; and how urban planning, design, and policy can contribute to creating healthier communities. Theory, case studies, the current policy and legislative framework in Victoria and Australia are used to highlight health challenges in cities, including four key population groups such as children, older adults, and disadvantaged populations. Students will learn to assess the health impacts of planning and design decisions, and identify urban policy responses to protect and promote health.

Learning Outcomes
On completion of this subject, students should be able to:
- Demonstrate an understanding of the changing nature of public health issues, and their relationships with the built environment.
- Describe key health risk factors in cities and how these vary between different geographic, demographic and socioeconomic groups.
- Assess planning proposals and existing areas in terms of their current or potential health impacts.
- Critically analyze the integration of Council Plans, Municipal Strategic statements, municipal public health plans, and state government policies and plans in Victoria.
- Apply the concepts of healthy urban planning to current policy initiatives at the local, state and national level;
- Develop diverse planning responses for improving the health of communities.

Assessment Task (AT) Description

<table>
<thead>
<tr>
<th>Assessment Task (AT) Description</th>
<th>Timing and grade %</th>
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</thead>
<tbody>
<tr>
<td>AT1: This site assessment essay is about understanding the characteristics of the built environment that influence the health of a community. Students are required to interview members from a community, upload their interviews to receive peer feedback. Then write a 1000-word essay evaluating the literature and evidence collected.</td>
<td>Due week 4 - 20%</td>
</tr>
<tr>
<td>AT2: 1500-word essay focused on understanding and evaluating the Victoria Public Health and Wellbeing Plan. Students are expected to provide recommendations of how they would improve the proposal from the state government.</td>
<td>Due week 07 – 30%</td>
</tr>
<tr>
<td>AT3: Health impact assessment report and presentation. Students are expected to conduct a health assessment of a specific community. During a class field trip to that community, students receive a presentation from city officials, interview individuals from that community, and collect evidence. They are then required to write a 6000-word essay in collaboration and prepare a final presentation of their findings.</td>
<td>Essay due week 10 - 30% Presentation due week 12 – 20%</td>
</tr>
</tbody>
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7.3.3 What I think: Individual Beliefs

Before the PD program

Delia’s student experiences were based primarily on teacher-centred approaches. When asked to reflect on the initial findings of the diagnostic survey (Figure 7-15), which show a stronger tendency towards student-centred rather than teacher centred learning, Delia said,

“Yeah, I would think it is correct... I try to integrate technology into my teaching, but I find that sometimes it is very difficult to do it. And sometimes I drop it. I just don’t continue doing it. Um, and I revert back to the traditional approaches...I use usual materials to support my teaching, like the PPT, but not extensively...At the same time, I tend to put a lot of content into each lecture” (initial interview).

Figure 7-15 Case 3: Self-reported changes in pedagogical beliefs as measured by the diagnostic instrument by Norton et al., (2005).
To arrive at an understanding of the exact nature of Delia’s pedagogical beliefs, she was asked to reflect on how the use of pedagogy and technology by previous teachers had influenced her own teaching practice. Delia remembered being introduced to computers by older peers in high school who inspired her to learn as much as possible about technology due to their humour and abilities. Later during her university studies, she took a programming subject. Her learning experience with programming was so negative that she almost failed the subject. This completely overshadowed her initial positive experience with computers, and made her dread any future uses of technology, “... so we were asked to do some scripts, and I really hated it. Like making sure I didn’t make a mistake with one letter... I got annoyed with it. So, I said ‘I will never learn another computer program’. Yeah, it turned me off. Because I got annoyed” (initial interview).

As a result, Delia reported that there was great value in recommending that students learn to use technology to develop their own spatial abilities and be able to graphically represent their architectural designs, but she saw no value in attempting to become an expert herself in any of the technological tools. As such, she delegates technology use to tutors,

“If I usually get a tutor who [knows] this software, because I know them myself but not as an expert. I could use Photoshop; I could use SketchUp but.... You can tell me to do something, and it would take some time but I will do it.... So that is why I depend a lot on the tutor to teach those skills. But in terms of design principles, I could say that I know them. If you put this high-rise residence designed at a certain level, it could give this type of urban form. So you know, theoretically I could explain” (initial interview).

The influence of this experience in Delia provides insights into the nature of pedagogical beliefs which are tacit, unbounded and rely on episodic memory (Ertmer, 2005; Pajares, 1992). The strength of one belief may not only depend on the time it takes to form it, but as suggested here, the emotional charge of the experience may have overshadowed all other experiences.
**During the PD program**

Delia espoused student-centred ideas of how her curriculum should be taught and redesigned, but had little knowledge of how to make it happen. She endorsed her beliefs and intentions towards interactive, facilitative teaching and problem solving more than her beliefs and intentions towards imparting information (*Table 7-6*). Yet, her concern about putting too much content in her lectures was ever present. Delia was asked to reflect on how she thought her students learned,

"I think if you are really interested in a topic and you kind of get hooked on it [...] then you kind of develop a thirst for that information and learn it. And I think that’s the way one usually learns” (mid-way program interview).

Delia’s intentions and beliefs about learning seem to be directly related to increasing students' interest in the content and motivating them. These beliefs informed her efforts to design a task around a field trip, and have a large number of invited lecturers, including peers from her faculty.

Another feature of interviews with Delia was her tendency to feel overloaded and stressed, even when she was a student,

"I crammed all the time. Just because I did so many things at once, I think. Because I felt that I wanted to be perfect but got annoyed most of the time because it wasn’t perfect. And then I realize now that it is really about aiming for good enough and making sure that you actually address everything else” (mid-way program interview).

Delia reported that her understanding of her own nature as a student, influenced her to be more lenient with her deadlines and more caring about student’s well-being given that she could understand their busy lives. All of which may be reflected in her beliefs about pastoral care (*Table 7-6*).
Table 7.6 Case 3: self-reports of change in sub-components of the teacher beliefs and intentions questionnaire

Based on a Likert scale, with a maximum score of 10 except for facilitative teaching which amounts to a maximum of five points (Norton, et. al, 2005).

<table>
<thead>
<tr>
<th><em>no change</em></th>
<th><em>decrease</em></th>
<th><em>increase</em></th>
<th><strong>Beliefs</strong></th>
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<td>Problem solving</td>
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<td>Use of media</td>
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<td>Imparting information</td>
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<td>Knowledge of subject</td>
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**After the PD program**

When asked to reflect on how her teaching practice related to the teacher vs. student-centred continuum, Delia reported,

"Yeah, so I think when we say student-centred it’s really about understanding [...] how your activities would focus on student outcomes, ensuring that student outcomes are achieved at whatever duration that learning should happen. And in terms of teacher-centred, how can you approach teaching in a much more effective way” (final interview).

Notice that in Delia’s description, the teacher is still the most active participant, by being responsible for both students’ outcomes and effective teaching. Delia explained,

"Yeah...in the back of my mind, I’m lacking preparation every time I go into class [...] sometimes it manifests, sometimes it doesn’t [...] But it could be other reasons, like I was too tired, because I was doing admin stuff, but it’s always [in] the back of my mind that I’m not prepared enough [...] And also because I think some of the students also expect you, particularly international students, they really expect you to be giving them more content” (final interview).
In practice, as will be explored in the next section, Delia made a shift towards facilitative and interactive teaching, but her reflections provide insight to how low self-efficacy can influence an individual’s self-perception.

7.3.4 What I know: competencies

Before the PD program

Despite seven years of experience, Delia feels like a novice. Not only does she report low pedagogical and technological competencies (Figure 7-16), she also reports low content knowledge due to a lack of recent industry experience. “I read a lot of papers. I write a lot of papers […] I don’t think I have enough experience yet” (initial interview). Insufficient industry practice and previous experiences with technology seemed to have impacted Delia’s self-efficacy (Figure 7-17). She reported feeling more confident with instructional strategies than with the use of technology. This is partly consistent with Delia’s technology-related competencies which initially she reported as low (Figure 7-16).
When asked to reflect on her Pedagogical Knowledge, Delia provided insights into her student-centred beliefs,

“Yeah, so I usually use the think-pair-share-activities. Asking them to think about cases, and [asking things like] what would you think, what would you do? Role plays, I usually do a lot of those in the subject,” (initial interview).

Figure 7-17 Case 3: changes in self-efficacy in regards to pedagogical knowledge over the course of a semester
**During the PD program**

In the case of Delia, there was a need to find a balance between extended conversations on instructional strategies, and a more focused approach to technological support. Due to the nature of Delia’s curriculum, conversations were based on theory about case-based learning and the flipped classroom. Most importantly to support Delia’s beliefs about facilitative teaching, conversations centred on how to enhance engagement and collaboration. For instance, Delia was guided to restructure her lectures around essential questions to trigger critical conversations with peers. Peer feedback strategies on tasks were also redesigned and included in the curriculum.

The first ten minutes of every design consultation were devoted to hands-on-practice sessions with polling tools such as PollEverywhere, the LMS and mind mapping tools. The objective was to develop Delia’s technological abilities by helping her configure her tasks online, so that she felt ready to implement them in the classroom.

**After the PD program**

When asked to reflect on the findings from the final assessment instrument (*Figure 7-16*), which show considerable changes to Technological Content Knowledge, Technological Pedagogical Knowledge, and TPACK, the participant said,

"Yes, exactly. I think it was more understanding how to use the LMS more in-depth [...] before I was just basically presenting, you know, putting up announcements etc. [But] I think I went in more often than I would usually do [...] and I got more familiar with the tools I am working with" (final interview).

These reports are corroborated by an analysis using the Technology Integration Matrix to determine the quality of technology use within that learning environment (*Figure 7-18*). The findings indicate a shift in AT1 from basic technology uses for curriculum
delivery to more authentic, independent exploration of technological affordances. AT2 reflects a shift to conventional but more interactive uses of technology.

Figure 7-18 Case 3: Changes in the quality of technology integration based on the Technology Integration Matrix

7.3.5 What I do: teaching practice

Before the PD program

Delia's expressed considerable anxiety over her teaching abilities in a new institution. But she did not report low self-efficacy in any of her teaching behaviours (Figure 7-19). However, Delia had a pressing need to redesign her subjects. This made her especially willing and open to considering the suggestions from this PD program. Initially, her tasks were based on academic essays and she expressed concern over her communication skills, “I do a lot of examples, case studies, and stuff. But I find that people say that assessments are not clear. So yeah, I think it is more of my communication, you know?" (initial interview).
Figure 7-20 reflects a curriculum that was initially based on traditional assessment methods and did not include educational technology.
During the PD program

After an initial evaluation of the instructional materials, Delia agreed to redesign the subject’s tasks around case-based learning, and to infuse them with peer feedback and collaboration. To begin with, the subject handbook was restructured according to the guidelines of the syllabus as a communication guide (Lund Dean and Fornaciari, 2014). And marking rubrics were created and configured in the LMS to automate the grading process.

The assessment task (AT1, Table 7-5) site assessment essay resulted in a rich interrelation between content, pedagogy and technology. The task was updated around case-based learning and required students to interview two individuals from a community of their choice. The students were then asked to upload the interviews to the LMS, so two peers could provide feedback and tips based on the marking rubric. Then students were required to write an essay that reflected insights on how state policies in urban design had affected the health of individuals living in their chosen community.

AT2 Policy essay and AT3 Health Assessment report and presentation were also redesigned around authentic/case-based learning. AT2 was updated to include the latest well-being plan proposed by the state government, and the assessment report included a field trip to a community. As part of AT3 City officials did a presentation on the well-being plan for that community, then students had to interview people in the area, collect evidence, write an essay in collaboration and do an in-class presentation to report on their assessment of that community’s well-being.

Students were highly engaged in this task but voiced concerns about the logistics of transportation, their discomfort with group work and the amount of work required.
As mentioned in the last section, in order to support Delia’s ability to align her student-centred intentions with her actual teaching practice, she learned about the flipped classroom and engagement strategies. During the reflection on the video recording of the class observation, she was able to observe herself implementing more interactive teaching. She started the lesson by explaining the objectives for the session and having students discuss an essential question in small groups. Delia’s willingness to reflect on her own teaching and actually apply what she had learned was noticed and highly appreciated by the students who commented,

“One other thing that Delia does very well is that she engages everyone. I think I have heard every single person in the class talking. Like that doesn’t happen in every other class. But here you know what they sound like. She doesn’t really pressure you to talk. She asks an easy question and then people are like, I know that, and they want to tell people about it” (Student 3, focus group).

“I think for me personally, it was clear that they put in a lot of effort [both Tutor and Delia]. Sometimes you don’t see that in classes. And it was definitely focused on learning. So, it wasn’t going through the slides. They wanted us to think. To learn new ideas” (Student 1, focus group).

Another observation based on the video recording of the lecture is that Delia seemed to be using the LMS more, but didn’t use PollEverywhere or the mind mapping tools to enhance her lectures. When asked to reflect on her communication channels and uses of technology, Delia responded, “Yeah, I think [the tutor], actually put up a discussion board just today for the questions,” (mid-way program interview). It is important to note that Delia was still delegating management of technological tools to others.

After the PD program

Delia’s perception of the influence of the PD program on her teaching practice was expressed as follows, “Yeah, now I’m more aware. When I do something or I plan
something, I kind of already know what to anticipate in that sense, which is good" (final interview).

There is evidence to suggest that this awareness is related to increased self-efficacy in Pedagogical Knowledge and learning design (Figures 7-17, 7-19). This is shown in her explanation of how she would go about designing a module in her curriculum from scratch,

“So now, I'm the lead designer for general information module. What I'm doing at the moment is asking the group, What do you think are the objectives? What do you think would be the activities? And what outcomes do you expect? And I'm saying, how do you evaluate if the learning outcomes have been achieved? So we have already come up with the objectives, and based on these objectives we actually developed a framework and did a literature review of what's currently the discussion in theory, in the theoretical discipline and what we think is missing” (final interview).

Moreover, this awareness of an objectives-based learning process was fuelling her plans for the future of the subject, "I'm already planning at this stage, inviting people to lecture [...] ensuring that whoever is part of that whole teaching and learning process has an important role towards achieving the outcomes that I want" (final interview).

An interesting aspect of this case study is the fact that organizational culture did not come up in the conversations. Besides expressing discomfort with her teaching load, Delia didn't seem influenced by the expectations of her faculty.
7.3.6 Case 3 Discussion

The analysis of this case indicates that Delia’s teaching practice is transitioning through Kember’s (1997) teaching conceptions continuum. Delia started the PD program in the ‘transmitting structured knowledge’ stage, characterized by Delia’s concerns about presenting too much information, which made her students passive. By the end of the PD program, Delia’s teaching practice was representative of the ‘facilitative understanding’ stage characterized by Delia’s more interactive tendencies focused on guiding students to construct their own knowledge.

Delia’s awareness of her own beliefs changed her attitude towards technology. Delia’s pedagogical attitudes towards the use of technology seemed to be heavily influenced by previous negative experiences with a programming subject, which in turn meant that Delia seemed hesitant to adopt relevant technological tools. This led her to delegate the teaching of software to more knowledgeable tutors. Delia became aware of this during the PD program. As a result, she learned to use the LMS as more than a communication mechanism, and instead as a tool to enhance collaboration amongst students through group work.

In conclusion, the influence of this PD program in Delia’s teaching practice includes an increased in Pedagogical Knowledge manifested in a tendency for interactive teaching. Moreover, even if the was no integration of tools other than the LMS, Delia’s attitude changed from not using technology at all, to using the LMS to facilitate collaboration. This influenced Delia’s pedagogical beliefs, as there was an increase in both student-centred and teacher-centred beliefs and tendencies, with evidence of a continuing transition based on experience and active engagement with students.
7.4 Case Study 4 – Analysis of Findings

7.4.1 Participant description

Sandra has over thirty years of corporate experience, and 10 years of experience as a sessional lecturer teaching face-to-face courses in higher education. She is an accomplished subject matter expert in the fields of global outsourcing and contracting. At the time of her participation in this PD program, in addition to being a sessional staff member, she ran three different companies and taught corporate workshops on global outsourcing around the world.

In 1989, she moved from America to Australia. It was then that she began teaching corporates how to mediate, outsource and do contracts. But it wasn’t until after her Ph.D. in 2007 that she started to teach at the university,

“The teaching at uni is effectively a pro-bono favour to the university. And so I have been here ten years, as a subject matter expert, not a teacher. And it is important to know the difference. A subject matter expert that happens to teach. Rather than a teacher that happens to know something” (initial interview).

Given that Sandra is very time poor, she takes a “just-in-time” approach to professional development. For instance, if Sandra is planning to create a fully online course, she will actively seek out teaching and IT support. But given that she travels so much, she will rarely attend workshops or teaching conferences offered by the university. For the most part, it is Sandra’s industry experience that guides her classroom behaviours. As a result of her busy lifestyle, Sandra expressed her motivation to participate in this PD program as a need for “efficiency and effectiveness” (initial diagnostic survey).
7.4.2 About the subject

Subject 4 is an elective subject of the Masters of Engineering. The objective of this subject is to introduce students to the theory and practice of outsourcing as routine IT management practices. There are 30+ students in the cohort. The curriculum is made up of two problem-based assessment tasks. The delivery of the subject is based on the flipped classroom instructional method. This means students are required to prepare for a formal test prior to every lecture. There is no final exam and no tutorials. The cohort convenes every week for an intensive session of four hours. Students from past years are invited to speak on their career journeys in an attempt to inspire and motivate students.

The learning design of the subject is displayed in Figure 7-21 and is colour coded. Solid yellow boxes represent the PD activities that took place throughout the semester. The blue boxes represent lectures and there is one test per lecture. The ovals describe inquiry-based/experiential assessment tasks. Note that throughout this analysis the delta symbol in yellow draws attention to changes the learning design as a result of the PD program. Then, Table 7-7 includes a description of the subject's objectives and tasks.
Figure 7-21 Case 4: Learning Design Subject 4 including a map of the sequence and influence of the PD program in the participant’s teaching practice.
### Subject 4

This subject is an elective of the Master's degree (all specializations) in the School of Engineering.

**Subject Overview**

Subject 4 is a routine part of IT management. The concept of using external organizations (whether domestic or offshore) is considered an efficient and logical way to get things done and is indeed widely accepted in many sectors of the economy. However, the learning curve is significant, it involves considerable work by both parties on a daily basis, and the results are highly dependent on the capabilities of the people involved. The subject focuses on the crucial activities that make a difference between success and disappointment – in theory, and in practice. We will be following the Outsourcing lifecycle.

**Learning Outcomes**

On completion of this subject, students should be able to:

- Describe a range of managerial issues regarding outsourcing.
- Explain the lifecycle and corresponding ebbs and flows of bargaining power.
- Understand the practical difficulties and realistic success strategies for outsourcing.
- Justify decisions on what and how to outsource.
- Recognize personal negotiation styles and how that influences approaches to outsourcing as well as results.
- Empathize with challenges facing both purchasers and providers and form pragmatic solutions.
- Demonstrate a practical ability to write an SLA (Service Level Agreement) to a commercial standard.
- Independently research and argue the disparate beliefs/theories of outsourcing.

### Assessment Task (AT) Description | Timing and grade %
--- | ---
AT1: SLA (Service Level Agreement) Students are provided an SLA between a service provider and a consultancy agency on the most and are asked to analyze the most effective way to implement the customer service helpdesk. Students have to re-write the SLA to a commercial standard. They have a max of 1500 words. | Due week 4 - 20% |
AT2: Debate paper and presentation – Students are assigned to a group of 5 people. Each group is to choose a subject related to outsourcing that they wish to debate. Arguments have to be evidence-based and the group needs to reach a decision regarding the most persuasive argument. Maximum of 3500 words. Students are then required to provide peer feedback on collaboration and leadership. They are required to do an in-class presentation on their argument. | Due week 10 – 25% debate paper 15% peer feedback |
AT3: Critical thinking open answer test prior to every lecture. | 30% |
7.4.3 What I think: individual beliefs

Before the PD program

Sandra's pedagogical beliefs seem to have been influenced by her upbringing in the American educational system where active learning approaches, such as problem solving were central to her experiences. This may have led to Sandra's high student-centred beliefs and intentions (Figure 7-22). When asked to reflect on her initial diagnostic results, she responded,

“Well, that primarily has been a time factor. But I would say that I did make a move when I flipped the classroom to make sure that I can do a deeper experience for them [students]. So there are no more lectures. So I no longer put myself as the center of their knowledge. So you have a perfect student here for I am in transition from being the font of knowledge to a more facilitative approach. And you will find some selfish practices, and that is because of time” (initial interview).

Sandra continued to reflect on the influence of previous teachers and their uses of educational technology in her current practice. In terms of uses of technology, Sandra
remembered that in high school, one of her teachers put her in charge of the first Lisa Mac computer in her school, “So, it was like, 'here we have this, Sandra. Figure something out, and show it to the class'. So I did. And the teacher would not come into class, and so I would be running classes for them in high school” (initial interview). This experience not only kick-started Sandra’s teaching career but it also greatly motivated her to become an IT accounting expert, which put her at the forefront of the field back in the 80s. However, this positive attitude towards technology was overshadowed by a negative experience during her Master's degree. In fact, when asked to think of other positive experiences with educational technology, she couldn’t remember any good ones.

As Sandra’s career evolved, time became a key obstacle to her technological abilities, she explained,

“So I was a leader in the technology space at a young age in these big firms. I've let that slack off [...] but the willingness to give technology a go is there. Sometimes what you find is that some of it pays off, some of it doesn’t. And the problem is that I don't have the time for it not to pay off anymore.” (initial interview).

**During the PD program**

An incident that gave some insights into the nature of Sandra’s pedagogical beliefs was getting relocated to a new classroom due to renovations. The new classroom was set up to have students work in small groups in roundtables, there was an interactive whiteboard and LED screens on every wall. It was an ideal setup for collaborative group work. A design consultation focused on how to use the setup to her advantage. The change created discomfort, 

“I might go back to a theatre-style room. Even if I really like the idea of this room I have now, I want to see the basic set up [...] that particular room has those pillars, so I cannot make eye contact. I didn’t realize how much eye contact was really important to me. And I’d rather have eye contact
with them, than the students having eye contact with each other. Is that selfish?” (mid-way program interview).

Table 7.8 Case 4: Self-reports of change in sub-components of the teacher beliefs and intentions questionnaire

Based on a Likert scale, with a maximum score of 10 except for facilitative teaching which amounts to a maximum of five points (Norton, et. al, 2005).

<table>
<thead>
<tr>
<th>* no change</th>
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<th>Beliefs</th>
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<td>Initial</td>
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<td>Initial</td>
<td>Final</td>
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<tr>
<td>Learning</td>
<td>Problem solving</td>
<td>10</td>
<td>10</td>
<td>10</td>
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<td>facilitation</td>
<td>Interactive teaching</td>
<td>10</td>
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<td></td>
<td>facilitative teaching</td>
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<td>pastoral interest</td>
<td>7</td>
<td>6</td>
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<td></td>
<td>motivator of students</td>
<td>10</td>
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<tr>
<td>Knowledge</td>
<td>Training for specific jobs</td>
<td>5</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>Transmission</td>
<td>Use of media</td>
<td>10</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Imparting information</td>
<td>6</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Knowledge of subject</td>
<td>10</td>
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<td>10</td>
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Sandra demonstrated tendencies for knowledge transmission. She explained, “No, I can talk for days. It’s actually easier for me to do. Seriously, I teach 30 days in corporate. In fact, that is my problem” (mid-program interview). To trigger further reflection, she was asked to describe how she thought students learned,

“*Their test scores go up [...] That indicates to me that they are learning something. Their tests aren’t getting easier. They are the same. They’re learning the test mechanism, but I think they’re also learning that I want you to understand and interpret information based on what you read [...] Learning is a few things. One is increasing your knowledge, but it’s also the increased ability to think quickly. Also self-awareness and being able to apply that self-awareness*” (mid-way program interview).

In the initial assessment instrument, Sandra reported high beliefs and tendencies for facilitative, interactive teaching and problem solving (*Table 7-8*). But her self-reports during the interviews reflect some teacher-centred beliefs.
The class observation confirmed Sandra's tendencies toward knowledge transmission, and that seems to derive from her corporate teaching style in which she is a consultant expected to perform. As she was watching the video recording of her performance, Sandra explained that in her corporate teaching she could tap into professional experience, whereas students wouldn't express their opinions, and refused to take responsibility for their own learning. Sandra was then asked to reflect on herself as a student, and how that understanding influenced her interactions with her own students. Through the conversation it dawned on her, “I cannot teach to me, to the younger me, and that’s probably what I try to do. I try to teach the younger me. But that represents maybe 20% of the cohort that are self-learners” (mid-program interview). Sandra suddenly realized how her own learning approaches as a student influenced her expectations of her own students, and this in turn was impacting her ability to create meaningful interactions with all students in her cohort. This realization was a turning point in this case. It made Sandra willing to invest her time and effort into improving her teaching practice.

After the PD program

During the final interview, Sandra asked to describe the meaning of student vs. teacher-centred approaches and how her teaching related to it,

“Student-centred learning is not about the instructor at all. It’s about the students. But you have to create learning pathways. You know, ways to help them learn on their own and be self-learners. The big challenge is bringing the rest of the curve into a self-learning situation [...] And I put a lot of time into thinking about the student learning journey. But I never, as we talked, let them learn for themselves. So, I’m doing that now and it’s hugely successful” (final interview).

The results of the final assessment instrument show Sandra's intentions towards student-centred beliefs and intentions didn't change much, but her teacher-centred beliefs increased while her intentions decreased (Figure 7-22). The changes concern a
large decrease in intentions for imparting information but a slight decrease in interactive teaching (Table 7-8). In fact, one of the most visible influences of this PD program in Sandra’s attitude is a shift towards less content and more facilitative teaching to enable an improved flipped classroom approach. This is a direct result from the watching her own videotaped performance,

“In particular your voice is always in my head, ‘You are ignoring that group, You are answering only their questions’ So I walk down there and talk to them. So I’m much more self-aware. Like when you videoed that and I was obviously playing to the younger me, and only talking to the overachievers” (final interview).

This reflection resulted from extended conversations to help Sandra realize that she didn’t need to perform, rather she needed “to hand over the computer” so that students could discover their own abilities just as she did in high school. These efforts were noted by students who expressed,

“She gave us a lot of freedom compared to other subjects. So we just have to go through a lot of documents to make sure our SLA fit her requirements. That is kind of hard, but I do feel like I learned a lot” (Student 2, focus group).

Interestingly, as with Hillary, Sandra also explained that her initial diagnostic was inaccurate,

“So, my original assessment in hindsight was egotistical. I mean, I wasn’t informed enough. I’m much more informed now. So, my baseline knowledge was less. So, I scored myself possible more confident in a smaller domain. Now I have a bigger domain” (final interview).

7.4.4 What I do: competencies

Before the PD program

Sandra has substantial content knowledge. She has written 19 books and has published 126 best practice research publications. This makes her comfortable as a content
matter expert, to the point that she claims, “I am the content” (initial interview). In fact, her subject matter expertise informs her pedagogical approach,

“I tend to tap into people’s personal experience, so knead that out, and bringing it into the limelight, and showing them how things can be different for them [...] I take them on a journey. I create AHA moments. So, it is easy with corporate because I tap into stuff, I struggle with students because they have no experience, and not enough context to create AHA moments to take them from a place, to create some highs and lows” (initial interview).

Sandra’s Pedagogical Knowledge is high (Figure 7-23). This may reflect overconfidence due to a lack of knowledge, given that Sandra was outspoken about how she had an experimental, more intuitive approach to pedagogy,

“I absolutely love just working with the students and taking them on a journey. So that will happen no matter what. So, it comes more from experimentation. And I tell every group, ‘this is what I am experimenting with you to see how this goes’. So just so you know, a lot of terms that you are going to use, I probably don’t know. But I cannot, I do not have the time” (initial interview).

However, there seems to be an association between self-reports on Pedagogical Knowledge (Figure 7-23) and self-efficacy around knowledge of active learning elements (Figure 7-24). In addition, Sandra’s ratings of her technology related TPACK components were low (Figure 7-23). This seemed surprising for a person who used to perceive herself as a technology expert. After seeing her initial diagnostic results, she explained,

“Now, here is the sad thing, my previous career was originally a technology degree. And I haven’t maintained that. Now, my technical knowledge is not on the systems the academics use. Because they are so badly designed that I cannot in moral conscience use them. So I use things that have nothing to do with that. So I introduce theory, and we’ll do things on other platforms. So I would say zero for the university’s technology environment. And then we can say above average for the industry” (initial interview).
Figure 7-24 Case 4: Self-reported changes to TPACK competencies, as measured by the TPACK assessment instrument by Schmidt et. al, (2009)

Figure 7-23 Case 4: changes in self-efficacy in regards to pedagogical knowledge over the course of a semester
During the PD program

To support Sandra’s competencies, conversations around pedagogy concentrated on the flipped classroom, problem-based learning, peer instruction and cooperative strategies as methods to increase student engagement. By this point in the PD, Sandra had changed her attitude and had become willing to increase the use of the LMS. So, the first ten minutes of each session focused on hands-on training with Poll Everywhere as a polling tool, and on configuring her tasks on the LMS. Most of the PD program was focused on these two tools as she was constantly voicing her frustration with their functionality. The strategy was to wait until she felt comfortable enough with these tools before introducing a new one.

Mid-way through the program Sandra was enthusiastic about the potential she was discovering,

“What I really want to use Poll Everywhere is for people who are embarrassed about their English. It provides another way to communicate. I think I can get everyone used to it [...] I’m also planning to put the debate paper on Turnitin” (mid-way program interview).

7.4.5 After the PD program

When Sandra was asked to reflect on the influence of the PD program on her teaching competencies, she started by addressing the small changes to Pedagogical Knowledge (Figure 7-23),

“As a result of our time together [...] I have cut down content. I do not have to spray them [students] with theory. So I cut down, and I changed a lot of it into experimental self-learning but in class, where I can be a cheerleader, not a coach [...] And I know that the questions they are asking this year are sharper than in the past” (final interview).

The most noticeable change regards Technological Content knowledge and TPACK (Figure 7-23). Upon seeing her results, she reported, “What my students have said is that
I’m the only flipped classroom they’ve experienced in the faculty. And I’m the only one using PollEverywhere, which they loved” (final interview). During the focus group, the students did notice the approach but reported that they would have liked to see less structure to the tests, more discussions in small groups and more open-mindedness on the part of the instructor on different opinions on a topic.

Another interesting factor is that Sandra’s self-efficacy showed little change (Figure 7-24),

“PollEverywhere is helping Chinese student engagement a lot. And my confidence reflected there. You have shown me so much tech that now I know these tools are out there […] I guess it is not higher because I don’t feel confident until I’m competent […] I know I can make any tech work when I put the time in” (final interview).

7.4.6 What I do: teaching practice

Before the PD program

Two things were evident about Sandra’s initial reports of her teaching practice. The first one is that she didn’t like using educational technology in her teaching due to claims of poor design, functionality, and lack of accessibility. When asked to reflect on her Technological Pedagogical Knowledge her answer was, “I don’t do it” (initial interview). The second aspect was that due to lack of time and her personal tendency for discovery and self-directed learning, her Pedagogical Knowledge is intuitive and experimental. Sandra also has a tendency to deliver too much content, so even if her beliefs are based on facilitating learning, she tends to revert back to more traditional approaches because for her it seems easier just to talk. Nevertheless, she reported actions such as,

“So we role play, and I give them challenging things to think about. With the flipped classroom, they show up and have to take a test. So there is no final exam. So they have to have done their basic
learning before they show up in the classroom. And then we have a critical conversation” (initial interview).

Initially, AT1 was based on problem-based learning and AT2 on a debate. As seen in Figure 7-25, initially, the quality of both assessment tasks was rated low due to Sandra’s refusal to use the LMS. In fact, the instructional materials were set up to instruct students to submit their work via email. Also, the rubrics lacked detail and were therefore limited in their ability to support self-regulation.

During the PD program

The first change as a result of the initial design consultation was a complete restructure of the subject outline. Clearer instructions on how to request support, an introduction to the subject, and a map including how to prepare for each lecture were added.
Assessment task (AT1, Table 7-7) was also updated to include a detailed rubric, Sandra created a video tutorial, and the task was configured in Blackboard to avoid using email as a submission tool. Extended conversation regarded the use of the LMS to automate the grading process, but Sandra refused due to claims that she needed to grade remotely, and the LMS was not accessible enough.

AT2 was also updated to include a detailed rubric and was configured in TurnItIn. Also initially, the peer feedback assignment asked students to judge their peer’s performance, and only the best performance would get the full grade. Sandra reported that the language of the instructions created low-quality feedback in the past and were thought to promote negative competition. Therefore, the assignment was changed to focus on cooperation and leadership abilities.

During the class observation, Sandra was very energetic, enthusiastic, knowledgeable, and tried to entertain students by infusing her lecture with stories from her industry experience. However, she was often the main focus of the lecture. Students rarely had space for critical discussion. There was a short role play activity, but Sandra observed that she would only address the high achieving students. The remaining students sat in the back of the class just observing. This realization motivated a big shift towards more facilitative teaching and an adoption of best practice strategies around the flipped classroom. Sandra started to actively provide students the space to engage with the content and have in class discussions, “I struggle extraordinarily with this because as a subject matter expert, I want to tell them stuff.” (mid-way program interview).

**After the PD program**

Sandra reflected on the influence of the PD program on her teaching practice,
“A lot. So [now] I’m actually coaching; I’m not teaching. There’s been a huge change... when I handed them the computer, that was a great day. My lectures that I used to rate myself highly on because I’m an expert are now the least interesting part of the class [...] I think my experience is greater than those results” (final interview).

The most noticeable changes in Sandra’s teaching practice regard a shift towards more learning facilitation, and an increase in the use of educational technology in her teaching. These improvements are corroborated by an analysis using the Technology Integration Matrix (Figure 7-26). The findings indicate that both tasks in Sandra’s curriculum reflected a shift from conventional uses of technology (adoption level) to more independent exploration of technological affordances (adaptation level) in an authentic learning environment.

Sandra reported no changes to self-efficacy in regards to active learning methods, slight changes to selecting and using technological tools, a large change when it comes to implementing tasks and evaluating learning designs (Figure 7-27). Seeing these results triggered the following explanation, “...because I only have limited time, I can only absorb
one thing. And then I have to experiment and then I have to make it work. So, it’s taken a while now” (final interview).

Sandra also explained that her plans for the future of the subject included increasing the number of invited speakers, improving the design of AT1 by including a survey on management skills, and a blueprint to facilitate students’ ability to rewrite the SLA. She also planned to continue the use of the LMS and PollEverywhere.

Figure 7-27 Case 4: changes in self-efficacy in regards to competences over the course of a semester

There seems to be little influence of organizational culture in Sandra’s teaching practice. From the start of the PD program, the only time organizational culture was discussed related to a seeming disregard for the lack of industry experience of academic staff. When asked to reflect on what kind of advice she would give a struggling lecturer based on the what she had learned from the PD program, Sara responded,

“I don’t think anyone is self-aware enough to even know they need help. They’re like me. See, I always took comfort in my SES scores being if not the highest, nearly, for the last decade. So I thought, ‘I must be doing all right!’ [...] The university uses that SES to assess teaching. There is no other mechanism. So that was my only source of information. And I was never sure. But ok, they like it. But against what? Am I a good teacher? I don’t know. And this is why I signed up [to the PD program]. And I was
changed quite remarkably. In the sense that this [PD program] was self-assessment” (final interview).

7.4.7 Case 4 Discussion

There is evidence to suggest that Sandra’s teaching practice is transitioning through Kember’s (1997) teaching conceptions continuum. Sandra started the PD program in the transmitting structured knowledge stage. This manifested in Sandra being the presenter in charge of transferring information to students as recipients. She would structure content around a superficial understanding of the flipped classroom, but the source of knowledge was ultimately her. By the end of the PD program, Sandra seemed to have transitioned into the facilitating understanding stage. This manifested in Sandra’s understanding that as the facilitator, she was responsible for the process of helping students to learn, but knowledge ultimately had to be constructed by the students within an evidence-based, flipped classroom framework.

Sandra’s awareness of how her beliefs impacted her teaching practice resulted in enhanced teaching and technology integration practice. Consider that by witnessing her own teaching performance, Sandra became aware that she did, in fact, lecture all the time and that she preferred some students over others. Such awareness resulted in a more inclusive, flipped classroom method. This seems to confirm that pedagogical beliefs may be the driving force behind teaching practice, but without Pedagogical Knowledge, teaching practice may result in poor, superficial approaches.

Sandra’s altered her attitude towards using educational technology in her teaching. Initially, her motivation to participate in this PD program was a desire for efficiency and effectiveness. This raised concerns that her limited time would become an obstacle to successful PD outcomes. But even if during the PD program Sandra was vocal about her frustration with inadequate functionality, difficulty or time needed to learn new tools,
it became evident that her strong identity beliefs as a leader in technology reinforced her belief in the value of the PD process.

This case study also confirms the Learning Technology by Design approach as an effective PD strategy for technology integration. By infusing tasks with evidence-based approaches, marking rubrics, as well as using the LMS for peer feedback strategies resulted in deeper, more cooperative learning approaches by students. There was a lot more in class discussion and because students were marked on how their leadership skills influenced the outcome of their group projects, students seemed more invested in the planning and writing of their group reports.

Finally, in the current research project, this is the second case study that suggests participants may rate themselves more confidently due to an initial lack of knowledge.
7.5 Case 5 – Analysis of Findings

7.5.1 Participant description

Janis has over 20 years of industry experience and 18 months of teaching practice. She is an accomplished art director and film production designer. In 2016, she was appointed as a full-time lecturer at the university. Professional development for teaching in the form of PD workshops and consultations with learning designers is provided centrally by the university, but staff members in the Film and Television school rarely participate due to their off-campus location. In fact, Janis reported, “I got very little induction, and I didn’t even know there were twelve weeks in the semester teaching and withstanding hours” (mid-program interview). The lack of local support motivated Janis to seek out PD opportunities. First, she completed the Graduate Certificate of University Teaching offered by the university. Then, she signed up to participate in this PD program. Because she was new to teaching, Janis’ perceived a lack of control over the curriculum of her subject, she did not feel comfortable making any changes unless permission had been explicitly granted.

Initially, she indicated that her motivation to participate was to improve her teaching, given that she wanted to keep her contract as a lecturer. However, during the initial interview the underlying motivation to join the PD program was also reported as:

“What has become a problem for me is that there’ll always be someone, even in a small class of five, this year and last year, because I’m open and I ask their opinion on things, there’ll be one person in the class that thinks that I don’t know the answers. So they see me as weak, unknowledgeable and they’re actually being quite nasty to me […] there’ll be one that starts this negativity within the group towards me because I’m not standing on that high ground being like I know everything sort of person” (initial interview).
7.5.2 About the subject

Subject 5 is part of the Master of Production Design for Screen. There are five students in the cohort. The subject is based on project-based learning and is designed to consolidate the theory and practice in the entire Master’s program. Students develop production design concepts for two different feature films. While students collaborate as a group, they submit work individually. Students and lecturer convene for one intensive four-hour lecture each week. Lectures are quite informal and mostly based on critical discussion. There are no tutorials or final exam. There are also four industry experts that participate as guest lecturers throughout the semester.

The learning design of the subject is displayed in Figure 7-28 and is colour coded. The solid yellow boxes highlight the sequence of PD activities implemented throughout the semester as part of the PD program. Blue boxes depict a directed, lecture mode of delivery with expert guest lecturers in yellow. The ovals represent the assessment tasks described as project-based tasks. The delta symbol in yellow draws attention to changes as a result of the PD program and will be found throughout the text to highlight the nature of the influence of the PD program in the participant’s teaching practice. Table 7-9 below provides a description of the subject’s objectives and tasks.
Figure 7-28 Case 5: learning design subject 5 including a map of the sequence and influence of the PD program in the participant’s teaching practice.
Table 7.9: Subject and task descriptions Case 5

**Subject 5**

This subject is a core part of the Master of Production Design for Screen.

**Subject Overview**
This subject builds on the skills and knowledge covered in Design Processes and Principles A. The aim is to further develop students’ ability to understand and drive the film design process. Studio-based classes and theoretical design projects cover visual storytelling, research for period detail, design for the character and designing non-naturalistic environments.

**Learning Outcomes**
Upon completion of this subject, students should be able to:
- Demonstrate a deep understanding of the design process,
- Perform research in an effective and organized manner to inform designing a particular period for screen
- Understand and apply design processes and principles to develop full designs for screen-based media
- Develop well-considered designs for non-naturalistic settings.

<table>
<thead>
<tr>
<th>Assessment Task (AT) Description</th>
<th>Timing and grade %</th>
</tr>
</thead>
</table>
| AT1 – Project 1: Develop production design concept for Good Vibrations. In order to get the full grade, students need to fulfil the following requirements.
  - Research: written and visual relating specifically to scenes in the set.
  - Image boards: 1x mood, colour, dressing for both internal and external, 6 in total.
  - Script Breakdown: detailed for all scenes in the set.
  - Dressing plans: 1x dressing plan for both internal and external 2 in total.
  - Renderings: at least 2x internal and external, at least 3.
  - Process Journal
  - 800-word reflection | Due week 7 - 30% |
| AT2 – Readings. Preparation for and consideration of readings. Contribution to class discussion. | Week 1 to 13 - 5% |
| AT3 – Project 2: Develop production design for The Time Machine. In order to get the full grade, students need to fulfil the following requirements:
  - Overall Design concept: this should support the characters and key themes for the year 802,701.
  - Location Design: Including mood board, colour palette, rendering, dressing plans, sample boards, scale models, site plan.
  - Design development file.
  - 800-word reflection and peer feedback. | Week 13 – 60% project 5% Peer feedback |
7.5.3 What I think: individual beliefs

**Before the PD program**

Janis’ experiences with previous teachers seem to have influenced her beliefs. She reported that memorable experiences included clarity in the delivery of content as well as inspiring, dependable and admirable teachers. Negative experiences included teachers that bullied her due to her artsy, free-spirited personality. "I had a difficult time with a teacher when I was in film school, and I didn’t finish my degree because of him" (initial interview). Poor teachers, in her view, are reflected by a lack of passion, are low achievers, boring, disrespectful, overly serious and not approachable. Janis describes how when she was in primary school, she wished everyone would just leave her alone in the library to learn on her own, and she was annoyed to be in the classroom. “But everyone is different. Everyone wants a different approach. And that is what I believe the most strongly about teaching” (initial interview).

Janis’ experiences seemed to have shaped student-centred beliefs and intentions. When asked to reflect on the findings of the initial diagnostic survey which show high student-centred intentions and beliefs, but higher teacher-centred intentions (Figure 7-29), Janis responded,

“I teach masters students, so I feel like they should be self-directed. And I don’t profess. The main thing is that I don’t think I have all the knowledge. I should just be the catalyst for them to find out because I don’t think that there is a right or wrong answer either. Not in a creative work, you can’t have right or wrong answers [...] them making connections for themselves. Learning is about them doing it, not me. I can’t make someone learn. They’ve got to learn” (initial interview).
It seems, however, that at times Janis’ problems with classroom management forced her to shift towards more teacher-centred approaches,

“So when I try to get [students] to work out for themselves, some of them get angry at me and say there’s a weakness. That I am not giving them the answers, that I’m not telling them what to do, that I’m not standing at the front of the class telling them how they should do something. I’m trying to get them to work out for themselves because I feel that is the most engaging and most effective. But as I’ve been teaching over the last 18 months, I’ve had to modify more and more to become way more instructional and more prescriptive. Tell them exactly what I want them to do and when they want to do it by” (initial interview).

During the PD program

Janis’ interactions with students seemed to be causing her stress and forcing an uncomfortable shift in her pedagogical intentions. It also seemed to be creating self-doubt in her professional abilities. Janis believed that she should be caring (pastoral interest) and she had high endorsement of beliefs in learning facilitation, but this wasn’t
being enacted in practice (*Table 7-10*). Note also that she did not have strong beliefs or intentions towards the use of media but did attempt to seem knowledgeable in the classroom (knowledge of subject).

*Table 7.10 Case 5: Self-reports of change in sub-components of the teacher beliefs and intentions questionnaire*

Based on a Likert scale, with a maximum score of 10 except for facilitative teaching which amounts to a maximum of five points (Norton, et. al, 2005).

<table>
<thead>
<tr>
<th>* no change *decrease *increase</th>
<th>Beliefs</th>
<th>Intentions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Initial</td>
<td>Final</td>
</tr>
<tr>
<td>Learning facilitation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Problem solving</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Interactive teaching</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>facilitative teaching</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>pastoral interest</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>motivator of students</td>
<td>9</td>
<td>9</td>
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<tr>
<td>Knowledge Transmission</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Training for specific jobs</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Use of media</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Imparting information</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>Knowledge of subject</td>
<td>7</td>
<td>8</td>
</tr>
</tbody>
</table>

Janis’ student-centred beliefs are in alignment with her epistemological beliefs. She explained how she thought learning happens,

"Oh, finding out stuff. It's making connections. I can tell by the work that they've produced. Just, immediately. I can tell by the comments that they make in class [...] or if they've made a connection with something in their own research" (mid-way program interview).

Yet, mid-way through the program, Janis was still voicing her discomfort with what she perceived to be students’ perceptions of her pedagogical intentions,

"Because I thought I was coming into a post-graduate programme, I thought these students would all be really independent learners. And they actually- it's proved quite different from that, and so it's changed my whole approach" (mid-way program interview).
Janis was asked to describe herself as a student, and to reflect on how that understanding influenced the interactions with her own students. This triggered the following realization,

“I think that is probably the biggest negativity that I’ve gotta overcome is – I love when they rise to the occasion, but I get quite frustrated when they are not giving as much as I used to give as a student [...] I should be more accepting of all different levels of engagement” (mid-way program interview).

What is interesting is that Janis’ students seem to be fond of her, which is in direct contradiction to her own perception,

“I love [Janis]!” (student 4, focus group).

"she is always approachable to ask about aspects of our projects as well, at any point in the class and after the class. And that was a really strong quality because she is a super beneficial mentor to have on this sort of projects because she knows it so well, and she has done it for so many years” (Student 3, focus group).

“Exactly, she is not a textbook. She is talking with that experience behind her, and how it will be in the industry” (student 1, focus group).

During the class observation, Janis was able to see how her classroom behaviours resulted in informal discussions rather than lectures. There was an industry expert as a co-lecturer, and Janis was able to observe how together, they provided feedback to students infused with insights from their own industry experience.

**After the PD program**

By the end of the PD program, Janis reported a shift in her perception. It seemed as if she accepted her students varied approaches to learning.
“I think the students probably start with an expectation that it's gonna be teacher-centric, that's probably the way they've been taught. So it requires a weaning process [...] I don't think that is something that you necessarily want to rush. I think that with this group, there is still a reliance on me as they still sort of need me to guide them. Some people are totally ready for it, but others aren't ready for it at all, so it's good to be able to gauge the appropriate amount of guidance for each person, where possible” (final interview).

As a result of this shift in perception, Janis reported feeling more self-confident given that she was slowly building a better quality of teacher-student interactions in her lectures and a more in-depth relationship with her students. This shift resulted in a moderate increase in student-centred beliefs and intentions (Figure 7-29). When asked to reflect on how her teaching practice related to the teaching conceptions continuum, Janis said,

“...when the student makes the realization for themselves, rather than relying on the teacher to tell them whether they are right or wrong. Like developing a critical awareness of being motivated. Self-motivated and self-reflective enough to know when they're getting there, so the teacher becomes more of a passive guide rather than having a director [...] So that was something I learned in our sessions and that was great because it helped me achieve something I have always wanted. How to get the students to sort of becoming motivated and engaged with each other” (final interview).

7.5.4 What I do: competencies

Before the PD program

Janis' content matter expertise is deep due to her extensive industry experience. Yet despite her initial concerns over insufficient Pedagogical Knowledge, she reported high pedagogical competencies in the initial assessment instrument (Figure 7-30). This is at odds with her low self-efficacy in terms of knowledge of active learning methods (Figure 7-31). When asked to reflect on these findings, it became evident that her pedagogical approach is more closely related to her previous experiences as a student, rather than to her professional practice,
"I sort of want everyone to be free. I just want [students] to be free, inspired and just to really get into it and see how great it is. So I show them all this stuff, and I hope that they will get into it, and it works with some but it doesn’t work with all of them" (initial interview).

In regards to technology-related TPACK components, Janis reported high Technological Knowledge, Technological Content Knowledge, Technological Pedagogical Knowledge and TPACK knowledge (Figure 7-30). This is consistent with Janis’ self-efficacy in terms of knowledge about cognitive tools (Figure 7-31). However, Janis explains that her love for analog technology motivated her to do a film degree, but putting efforts into enhancing her Technological Content Knowledge is a totally different matter,

"Well, I’ve got a bit of a problem in my career, because I never learned Photoshop and I never learned CAD. I do everything by hand. That’s because I wasn’t interested in it. I’d rather do things by hand than on the screen. I prefer manual methods" (initial interview).
Janis’ personal preferences may partly be the reason why in regards to Technological Pedagogical Knowledge, she expressed, “I don’t know. I don’t really use it.” (initial interview).

Figure 7-31 Case 5: changes in self-efficacy in regards to pedagogical knowledge over the course of a semester

During the PD program

In order to support Janis’ competencies, the PD program focused on instructional methods such as peer instruction, project and case-based learning, as well as cooperative strategies to enhance student engagement with the content. Technological development took place during the first ten minutes of each design consultation and included hands-on-practice with PollEverywhere as a clicker system, mind mapping tools, and the LMS. Mid-way through the PD program, Janis requested help automating the grading process, so an additional design consultation was scheduled to help her configure the grade center in the LMS.

Also, given Janis’ lack of confidence in her instructional methods and classroom management abilities, ongoing support was provided via email and through sporadic design consultations throughout the semester. A direct result from this approach were
reports of an increase in self-confidence which enabled her to take more control over the curriculum,

“Everything we’ve talked about has been really helpful. It’s helped me realize that I can calm down a bit now and think a little bit more deeply. You know? Like, for a lot of the year it’s been quite manic just keeping up with everything and working out what’s going on and all of that. But now I can be a little more confident. I know I can focus my teaching a little bit more on what I want to improve on” (mid-way program interview).

After the PD program

Janis expressed that the greatest influence of the PD program was in relation to self-efficacy and Pedagogical Knowledge (Figure 7-30),

“I just feel more confident […] When you undertake this fresher development and you find out that there’s actual research behind those different types of teaching styles, it just gives it a bit more weight, so you feel even more confident. Like you are doing the right thing because the research supports it” (final interview).

Confidence seems to have been enhanced also by the understanding of how much direction to give her students,

“I think there’s always been this weird sort of opposition with me, in that I don’t know how much to direct people. So I want people to be free, but I understand they need direction, so now, I feel like I’ve found a middle ground” (final interview).

Janis’ self-perception of Pedagogical Knowledge seems to have decreased, which is in direct contradiction to the reported pedagogical knowledge (Figure 7-30) and high self-efficacy in regard to teaching, assessing, designing, and evaluating active learning methods, as well as, using the flipped classroom approach (Figure 7-31). In fact, Janis told the story of how she went to an interview to renew her contract as a lecturer, but she had trouble recalling the terminology used in the design consultations. This
provided insights into Janis’ likely misunderstanding of the terminology used in the assessment instrument.

Janis also reported an increase in ratings of technology-related TPACK components (Figure 7-30). This was verified using the LMS statistics for the subject which showed increased activity from both Janis and students. However, there was no uptake of any of the other tools that were introduced during the PD program. Given her preference for manual methods, it seems like the new technological tools did not align with her value beliefs. These findings are further corroborated by an analysis based on the Technology Integration Matrix (Figure 7-32). The assessment tasks in Janis’ curriculum reflected no change in the quality of technology integration, suggesting that the changes in her practice were based on Pedagogical Knowledge and self-efficacy, with only small enhancements to her technological setup.

![Figure 7-32 Case 5: Changes in the quality of technology integration based on the Technology Integration Matrix](image)
7.5.5 What I do: teaching practice

Before the PD program

Janis’ perceived lack of control over the curriculum of her subject created some issues, especially with regards to the grading process and clear guidance for her students. Initially, Janis’ instructional materials and LMS subject site followed an inconsiderate layout. The subject outline lacked clear instructions for students to request support and prepare for each lecture. The project briefs had unclear instructions on each requirement of the production design concept and included no marking rubrics. This impacted the quality of the learning designs (Figure 7-33). Moreover, the LMS layout was not user-friendly and an overwhelming number of readings were included. Also, Janis had no knowledge of how to configure the marking process or how to use Turnitin as a submission tool.

Figure 7-33 Case 5: Changes in the quality of fit in learning designs measured by the Technology Integration Assessment (TIA) Rubric
During the PD program

At the start of the PD process, design consultations focused on improving the learning designs of the subject. The first step was to update the subject outline with a brief description of the subject and assessment tasks, as well as instructions on how to contact lecturers for support. A map of the subject was also developed to include information on how to prepare for each lecture.

The project briefs (Table 7-9) were also updated to include clearer guidelines, and sample design concepts from previous students were uploaded into YouTube to support students' self-assessment and regulation. A detailed marking rubric was also created for each of the requirements in the project design concept. The marking rubrics were greatly appreciated by the students, out of whom said,

“I think the best part about the rubrics is that it lets us know how to do things, we can ask questions about how to approach things, which we may not have asked if we didn’t have to approach things in another way” (student 3, focus group).

The LMS layout was also updated with labels to indicate “must read” or “optional” readings, a submission space was created in Turnitin for each aspect of the project design concept, and the navigation menus, as well as subject materials, were reorganized to make the online subject more intuitive.

The immediate influence of this process was observed in Janis’ increased confidence to take control of the curriculum. She still felt the need to report to her supervisor all of the changes that were made, but she was no longer uncertain,

“Ever since day one, that first session that we did to get all the materials right. I suppose I was following what I’ve been given, and my natural thing is that I love to be really thorough and make sure everyone knows absolutely everything and it’s really foolproof [...] And I totally switched on to that, and now I think that’s a key thing that I’ll be applying to all my subject
Another relevant influence of the extended conversations on instructional strategies and class management is that Janis found the confidence to take control of the interactions with students, and started having individual conversations to encourage them to take advantage of their learning of opportunities. She describes the conversation with one of the most resistant students in her class,

“\textcolor{red}{\textit{I just took the time to have a really long discussion and let her know that there was nothing to be threatened by in our situation and that I was 100\% on her side, I really wanted her to succeed. And ever since that day, she’s become one of the best […] it wasn’t until we had a one-on-one that she let her defences down}}” (mid-way program interview).

\textbf{After the PD program}

When asked to reflect on the influence of the PD program on her teaching practice, Janis reported two main changes. The first related to the quality of interactions with her students,

“\textcolor{red}{\textit{The most profound difference is that I feel more confident. I feel our relationship [with her students] has developed a depth that indicates to me that they’re very engaged in the subject matter. So that may be, it’s obviously going to be a combination of time and teaching. I think the most profound influence of the work that we’ve done is that I’m more confident and they seem more confident in me, so they’re engaging more}}” (final interview)

Janis also reported large increases in self-efficacy around active learning and the use of educational technology tools (\textit{Figure 7-34}). Increased student engagement with the content was also confirmed by the students who said,

“\textcolor{red}{\textit{I can’t play video games anymore either, it [brain] is filled up with lamps and floor plans. So yes, I have learned a lot!}}” (Student 2, focus group).
Janis’ also reported more confidence in her ability to align interactive and facilitative teaching beliefs (Table 7-10) with her practice,

“I think that one of the most profound changes was when you did the observation of my teaching and I was able to see how better to step out of the dynamic and encourage them to speak amongst themselves more and it had always been my aim, but you gave me the skills to actually understand how to put it into practice” (final interview).

The students confirmed and valued this approach,

“And it is open for a lot of class discussion. We help each other out a lot with it. Like, even though it is our own personal designs, we collaborated and give each other critiques. And that method of having the class where we are always presenting our new ideas is really helpful” (student 4, focus group).

“And the fact that we have never been put in competition with each other. I think that is super important because I think that as much as Janis helped us, we help each other heaps, and I think we are much stronger, like as a team…” (Student 1, focus group).

Figure 7-34 Case 5: changes in self-efficacy in regards to competences over the course of a semester

Janis added that as a result of the updates to the LMS layout, she found there was “much better integration and [it is] easier for students to navigate” (final interview). In fact, Janis reported that her future plans for the subject included streamlining and
signposting the LMS even more and establishing communication channels right from the start.

Moreover, when asked to describe what would be the process to design a unit from scratch, she provided an explanation that reflects an in-depth understanding of constructive alignment and other learning design principles,

"Well, I’d start with the outcomes that I want to achieve and then work backward and I generally try and make the exercises as experiential as possible. So they are actually experiencing the learning process, rather than responding to something. That’s the way I would try to devise the projects. And I think it is really good to start with an example, so it gives them an expectation of where they are going to end up [...] to inspire them. I think what I have learned is to try and make expectations fairly concrete” (final interview).

7.5.6 Case 5 Discussion

There is evidence to suggest that Janis’ teaching practice may be in transition through Kember’s (1997) teaching conceptions continuum. Initially, Janis perceived that her role was characterized by the ‘teacher-student interaction’ stage in which she was the presenter and a tutor in charge of an interactive process with students as participants. By the end of the PD program, Janis’ teaching practice seemed to have transitioned into a facilitating understanding stage. She felt more confident and responsible as the facilitator of a process to help students learn. Both knowledge and content were transformed by students through collaboration and critical discussion.

Creating awareness about beliefs seems to not only enhance Pedagogical Knowledge but also self-efficacy. In Janis’ case, low self-efficacy resulted in stress and self-doubt which seem to have a direct influence on her perceived ability to interact with her students. She often suggested that her students were responsible for the outcomes of
her pedagogical approach due to a perceived disrespectful attitude towards her. Becoming aware of her expectations of the students, as well as getting reassurance that her students had a high regard for her, resulted in an increase in self confidence that seemed to transform her teaching practice. Her initial discomfort had dissipated and she reported the ability to create more in depth interactions with her students.

Janis’ new disposition also resulted in improved student engagement. The more confident Janis felt, the more facilitative and interactive the learning process became, which in turn seemed to have facilitated deeper learning approaches in students. In this way, this case study supports Schommer (1990)’s argument that epistemological beliefs can greatly influence the nature of the learning process.

Janis’ learning designs also enabled an increased quality of integration of the LMS, even though there wasn’t even an attempt to integrate any other technology-based tools. It may be Janis’ preference for manual methods that prevented her from assigning utility value to teaching with technological tools, and as such made her unlikely to invest the cost of time and effort needed to learn how to use them.

In conclusion, the influence of the PD program in this case study was only small in terms of technology integration. However, there was a clear increase in self-efficacy which seemed to enable better teacher-student interactions, deeper approaches to learning, more facilitative and interactive teaching, an increased control over curriculum of the subject, as well as an enhanced sense of the capability to respond to her teaching role.
7.6 Case Study 6 – Analysis of Findings

7.6.1 Participant description

Tina has over 37 years of experience as a health professional and five years of teaching experience. She is a nurse who likes working with patients but also enjoys teaching. At the time of her participation in this PD program, in addition to being a full-time teaching staff member, she was completing a Graduate Certificate of University Teaching (GCUT). Tina also attends many of the workshops and design consultations offered centrally by the university for pedagogical and technological support.

In 2000, she completed her Bachelors and Masters’ degree, online. This is important because Tina’s current teaching load only includes fully online subjects.

Tina expressed her motivation to participate in this PD program as follows,

“I teach content online. This is text-based and not interactive. I would like to engage students in active participation and utilize peer review so that they learn from each other. Due to the small class sizes, this is difficult. Sometimes I only have one student, so there is no possibility of networking or collaboration” (initial diagnostic).

7.6.2 Subject Description

Subject 6 is a core unit in the Graduate Diploma and Certificate in Primary Care Nursing. Its main objective is to introduce nurses to care strategies for chronic diseases. There were five students in the cohort and all of them are practicing nurses. The curriculum was designed around four assessment tasks which follow a case-based learning approach. Before the PD program, in this online subject students were instructed to read information on a topic, write a reflection journal and complete a quiz. There was no final examination.
One of Tina’s concern was the amount of effort required to update her teaching materials. To allow time for a proper redesign of the materials in collaboration, it was agreed to make this a year-long case study. Design consultation took place once every two weeks during the first four months, and once every month for the last seven months. The subject was implemented during the first semester of 2018, but data collection started during the second semester of 2017.

The learning design of the subject is displayed in Figure 7-35 and is colour coded. The solid yellow boxes highlight the sequence of PD activities implemented throughout the semester as part of the PD program. Blue boxes depict a self-directed study module with weekly quizzes following it in yellow. Webinars are in green boxes, while the ovals represent project-based assessment tasks. The delta symbol in yellow draws attention to changes as a result of the PD program and will be found throughout the text to highlight the nature of the influence of the PD program in the participant’s teaching practice. Table 7-11 below provides a description of the subject’s objectives and tasks.
Figure 7-35 Case 6: learning design Subject 6 including a map of the sequence and influence of the PD program in the participant’s teaching practice
### Subject 6

This is a core unit in the Graduate Diploma and Certificate in Primary Care Nursing.

**Subject Overview**

This subject introduces nurses to chronic disease management in primary care. Although working in primary care is not a requirement to complete this subject, students are required to relate the tasks and assessment to this area. This can be accomplished by completing the readings provided, referring to the websites that are recommended in the topic material and forming networks with peers. There is an emphasis in the subject on providing care that empowers self-management, is patient-centred, respectful of gender or cultural diversity and sensitive to the needs of minorities such as indigenous patients.

**Learning Outcomes**

On completion of this subject, students should be able to:

- Understand the pathophysiology of diabetes, asthma, chronic obstructive airways disease, hypertension and chronic heart failure,
- Describe the actions of some common pharmaceutical agents used in the treatment of these conditions,
- Describe the current management guidelines for these conditions,
- Appreciate the importance of patient-centred care in the management of chronic disease,
- Develop an appreciation of the social determinants of health on the impact of chronic disease.

### Assessment Task (AT) Description

<table>
<thead>
<tr>
<th>Assessment Task (AT) Description</th>
<th>Timing and grade %</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT1 – Academic Essay: Students interview a primary care health professional and upload a recording of the interview to the discussion board. Then they provide 500 words written feedback to at least one peer via the discussion boards. To conclude students complete 1000-word essay taking into consideration peer review, interview and literature.</td>
<td>Due week 5 - 16% Peer feedback - 4%</td>
</tr>
<tr>
<td>AT2 – Discussion Paper. 2000 words on a topic related to primary care. Students are encouraged to reflect on their own clinical practice.</td>
<td>Due week 11 - 60%</td>
</tr>
<tr>
<td>AT3 - Multiple Choice Quizzes. 5 open book quizzes throughout the semester, each include 15 questions.</td>
<td>Quizzes due weeks 3, 5, 6, 9, 10- 20%</td>
</tr>
<tr>
<td>AT4 – Reflective Journal. Students are instructed to read a topic guide and complete 4-7 tasks per topic, and students need to submit their reflections.</td>
<td>Due weekly – Pass/Fail Hurdle.</td>
</tr>
</tbody>
</table>
7.6.3 What I think: individual beliefs

Before the PD program

Tina’s pedagogical beliefs have been strongly influenced by her own student experiences. She recounts many negative experiences, including unapproachable or abusive teachers that would smack students. Later at university, she experienced practices such as being assessed on material that would not translate into practice. On the other hand, positive experiences included approachable, caring teachers who inspired students with their knowledge and willingness to provide support. In Tina’s case, these experiences have shaped a student-centred view towards facilitation (Figure 7-36). However, there are also large teacher-centred tendencies. When asked to reflect on the results from the initial diagnostic (Figure 7-36), she responded,

“My students, I see them come in with a set of beliefs and leave with the same beliefs. So I want to push them because I see that they don’t engage that deeply. I do try to put things to make them think, but they don’t, so I push them a bit more. It’s really about trying to get them to take on this idea about social determinants, which is really things that are happening in your life that affect your ability to be healthy and try to get them to start to think like that because I think it is the right way. I think I’m just impatient. I want them to discover it in the first week. I want them to go, ‘oh, yeah that’s great’, whereas it’s kind of like pushing it down their throats” (initial interview).

Tina describes herself as an independent discovery learner. This view of herself as a student seems to influence her expectations of her own students, perceiving them to be passive learners which results in frustration and impatience,

“I enjoy online learning I don’t like sitting in lectures [...] but not everybody likes that. We get feedback from the Student Experience Surveys saying, ‘I could have learned much more in the classroom’. People like the idea of online, but they don’t actually like online learning. They want online, but not our online” (initial interview).
Despite the sense of disquiet in relation to expectations of her students', there is a positive predisposition to the online context. Tina's own experiences as a fully online learner have resulted in a caring attitude because she understands the reality of her students' busy lifestyles,

"My students are now my patients. Being a middle-aged cohort of students, they have lots of issues. They've got issues with their kids, they've got issues with illness I've got a few of them with cancer. They're my pseudo-patients [...] I try to give them as much leeway as I can with extensions and things to help them to get motivated. You still got to get them to do things on time and be prepared and to meet the deadlines and prioritize" (initial interview).

**During the PD program**

Tina continued to express disillusionment with her students' approaches to learning, "I do expect the students to work hard. I do often find myself thinking, 'I'm spending more time giving you feedback that you've actually put effort into this essay'. And that annoys me" (mid-way program interview). For a deeper understanding of Tina's teaching
practice, note that her intentions towards knowledge transmission are higher than her beliefs (Table 7-12). There are also noticeably low intentions towards interactive teaching, even if Tina's initial motivations are to increase engagement. Moreover, initially, Tina reported difficulties with using technology to communicate with her students.

Based on these insights, the approach throughout the PD program was to help Tina increase the quality of communication with her students in the hope that increased interaction would enable a more positive perspective. This may be the reason for the increase in interactive, facilitative teaching and use of media (Table 7-12).

**Table 7.12 Self-reports of change in sub-components of the teacher beliefs and intentions questionnaire**

*Based on a Likert scale, with a maximum score of 10 except for facilitative teaching which amounts to a maximum of five points (Norton, et. al, 2005).*

<table>
<thead>
<tr>
<th>* no change</th>
<th>*decrease</th>
<th>*increase</th>
<th>Beliefs</th>
<th>Intentions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Initial</td>
<td>Final</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Initial</td>
<td>Final</td>
</tr>
<tr>
<td>Learning facilitation</td>
<td>Problem solving</td>
<td>10</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Interactive teaching</td>
<td>8</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Facilitative teaching</td>
<td>4</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Pastoral interest</td>
<td>8</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Motivator of students</td>
<td>8</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Knowledge Transmission</td>
<td>Training for specific jobs</td>
<td>8</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Use of media</td>
<td>4</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Imparting information</td>
<td>6</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Knowledge of subject</td>
<td>8</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

Tina’s facilitative and interactive intentions are evident in how she describes the teaching-learning process,

"To me, it is not about memorizing facts and figures but it's about being aware of what I don't know. I have to go look it up but [...] it's having the scaffolding to be able to take new information and turn that into something useful [...] In my subject I look at what they put in their reflective
journal to see if they've processed it and changed it from the way it was given to them. So, what I look for is for them challenging the materials, but I think that is difficult for many in an online space” (mid-way program interview).

Throughout the PD program, it became apparent that Tina’s knowledge transmission intentions related to not knowing how much guidance and information to give her students in an online context. Tina was also aware that there was too much content in her subject, and she reported that in the past this created issues with students feeling overwhelmed. To help Tina manage the content load, an entire design consultation focused on reviewing the topic guides to see if the number of suggested readings could be reduced or if they could be labelled as "must read/optional" materials.

**After the PD program**

When Tina was asked to reflect on the results of her final assessment instrument (Figure 7-36), she said,

“Ok, so I think to be teacher-centred is giving them the information, whereas student-centred is really giving them something and then making them go and do work and find information. But I find it hard in the online environment not to give lots of information because you don’t see them. You don’t have any interaction with them. So if you don’t provide that information, I can’t be confident that they’re actually going to go and find it out. So, yes, I understand what the idea is. But I’m not sure that it can always be translated into this very kind of set and forget online context” (final interview).

Tina believes that online instruction needs to be more structured. One of the examples she gives is the discussion boards. She believes that if they are left blank, there will be little or no input from students. However, if discussion boards are more structured and a small percentage of the grade is assigned for participation, students will be more likely to contribute.
7.6.4 What I know: competencies

Before the PD Program

Tina's previous online learning experiences have created a positive predisposition towards online teaching. However, a lack of Pedagogical Knowledge, Pedagogical Content Knowledge and Technological Pedagogical Knowledge (Figure 7-37) may have created issues,

“I don't really have any Pedagogical Knowledge at all. I've never been taught how to do this. So, it's just kind of try things and see what works. Maybe it's the theory I'm not familiar with” (initial interview).

The initial diagnostic showed higher Technological Knowledge and Technological Pedagogical Knowledge (Figure 7-37). However, it is these specific competencies that seem to be creating the most anxiety. “Yeah, I like using the online space, but I feel there’s a lot more that the platform can do but I just don’t know how to use anything” (initial interview). In light of Tina's motivation to join the PD program, and discomfort with her technological abilities, she was asked to describe her previous experiences using technology to communicate with students,

“I've tried to use ZOOM, and I've found that a bit dicey technology. It's very noisy when I've tried to use it. I find it very difficult speaking into nothing and getting no feedback. You want to have students there so you can see them, but if they've got their mics on it’s so loud, and sometimes they don't get the invite, and they're not able to log on, and I don’t know how to help them troubleshoot. If there is something better than ZOOM, something with less background noise, that would suit me” (initial interview).
ZOOM is the university's endorsed video conferencing system, making it the most functional option for teaching staff at this university. Tina’s experiences reflect a lack of confidence, knowledge and ability to troubleshoot possible technological issues. This is supported by her self-reported efficacy which shows low confidence in regard to active learning methods and using cognitive tools (Figure 7-38).

During the PD Program

Strategies to develop Tina's pedagogical abilities and increase her confidence focused on case-based and online collaborative learning. There was also a focus on strategies to increase teacher-student interactions. For example, she was introduced to cooperative, peer feedback strategies, using the discussion forums to post cases as “reflection stations” to trigger critical discussion, using Hangouts to offer online "office" chat hours, and implementing at least two webinars a semester.
Because of the online context, technological training related to the use of ZOOM, Blackboard, PollEverywhere as a polling tool, Google Hangouts for communication, and later, PowToons as a tool to create animated demonstrations. The first 20 minutes of each design consultation were devoted to hands-on-practice sessions with these tools. However, an entire consultation was set aside to help Tina upload her tasks online. Moreover, in the case of ZOOM, a consultation was devoted to showing Tina how to implement a webinar; another consultation was devoted to role-play scenarios in a simulated webinar.

Mid-way through the semester, Tina was already reporting the benefits of these strategies included relating to her students as colleagues,

"We're nurses here. I would like it to be like we're all in this together, we're all learning together and sharing experiences. I think that's difficult. You can do that in a class situation where you're all sitting together and just sharing your experiences, but it's more difficult in an online environment" (mid-way program interview).
After the PD program

Tina was asked to reflect on the findings from the final diagnostic (Figure 7.37), which show a large increase to Pedagogical Content Knowledge and Technological Pedagogical Knowledge, but no changes to Pedagogical Knowledge, Technological Content Knowledge or TPACK. Similarly to Hillary (case 2), Sandra (case 4) and Janis (case 5), Tina admitted that initially, she rated herself higher on the diagnostic instrument due to a lack of knowledge,

"I didn't even understand the questions. I had no idea whether I was able to do that or not when I first started. So yeah, that would have been why that is so low" (final interview).

Also the instrument being used referred to classroom practices, and that confused the participant,

"Oh, when I filled out the survey a lot of it says 'classroom' and I don't teach in a classroom, so I said 'no'. I gave that a low score because my skills in classroom teaching wouldn't have changed at all" (final interview).

The final confidence log (Figure 8.38) shows a 60% increase in self-efficacy with active learning methods and using cognitive tools. Interestingly, in Tina’s case, more knowledge seems to have reshaped the expectations of her own practice and that affected her self-efficacy,

"I think the more you learn what you should be doing, the less confident you feel that you are doing it. When you don't know, you think, 'oh, I'm doing fine.' And then you kind of go, 'well, actually, I could be doing better" (final interview).
7.6.5 What I do: teaching practice

Before the PD program

Tina was aware that the teaching materials she used needed improvement. The handbook did not include sufficient week-to-week guidance on how to approach the study material. It was also not explicit that students were expected to read an average of 15 articles per topic and use that information to frame their assignments. One of the instructions was that all quizzes and the reflective journal were to be submitted before the end of the semester, however, no structure was provided to complete the task. The online subject was a repository of PDFs with little organization to help students navigate or organize their self-directed study. The marking guidelines were poorly developed. And there were few videos and interactive materials available for students. There were no active communication channels other than email or the discussion forums, which Tina found frustrating because students did not use them frequently. Also, there were also little opportunities for interaction among peers. This had initially resulted in a low quality of technology integration in each of the learning designs (Figure 7-39).

![Figure 7-39 Case 6: Changes in the quality of fit in learning designs as measured by the Technology Integration Assessment (TIA) Rubric](image-url)
During the PD program

The first part of the PD program focused on collaborative redesign of the teaching materials. The first step was to transform the subject outline into a student handbook. This update included instructions on who to contact for support, an introduction to the subject, a map of the subject including step by step suggestions on how to study week by week, as well as assessment deadlines and dates for the webinars.

Next, the assessment task one (AT1, Table 7-11) was divided in two parts, an interview and an essay. A percentage of marks were allocated to peer review of the interview. Questions were added to guide students on how to provide positive, constructive feedback. Tina was also assisted to create a discussion forum for students to submit their interviews and peer feedback, and she was supported to upload and configure her task on the LMS. A detailed marking rubric was also created to support self-regulation and self-assessment. The changes to the assignment were appreciated by students,

"It was useful to spend time talking to another health professional about the issue of patient-centred care as it helped me gain clarity around what I wanted to discuss in my assignment" (Student 2, focus group).

The guidelines for the AT2 were updated for clarity and Tina was supported to configure the task on the LMS. A detailed marking rubric was also created. AT3 was also organized in a more coherent way. The prompts were highlighted, and there was a journal space available in the LMS to submit the work on a weekly basis, which allowed Tina to provide more formative feedback.
Another important update, given the context, was a complete reorganization of the online subject. The content was divided into weeks rather than by topics. Each week included links to the suggested readings, discussion boards, it included a space for students to write their reflective journal entry and links to the quizzes. The idea was to support self-regulation by allowing students to navigate by weekly chunks.

The most influential update to the curriculum was the inclusion of two webinars. The first was a community building session and the second webinar was a discussion session that focused on a critical component of the subject: health care plans. Note that Tina's willingness to hold webinars is a change in itself. Tina started the PD program expressing a strong dislike of ZOOM. However, sometime during the PD, Tina was required to participate in a ZOOM webinar as part of her GCUT studies. Tina's ability to witness a peer modelling the facilitation of a webinar profoundly changed her attitude and perspective. It made her willing to request assistance with the technological side of ZOOM. After only two design consultations, Tina implemented her first community building webinar. She used this webinar as an opportunity to get students to get to know each other, introduce herself, the subject, and answer questions on AT1. The strategy for Tina was to leave the webinar meeting, instructing students to continue to talk amongst themselves, and establish their own communication channel. The students chose to use Facebook Messenger as a communication method for their online learning community and stayed connected throughout the semester.

These changes in Tina’s uses of technology, in her teaching, are corroborated by an analysis based on the Technology Integration Matrix (Figure 7-40). The findings indicate a shift in AT1 from basic uses of technology to deliver curriculum to using technological tools to facilitate higher order thinking in a collaborative learning environment. AT3 also reflected a shift from conventional uses to more independent
exploration of technological tools in a constructive learning environment (AT2 reflected no change).

The benefits from these strategies on Tina’s teaching practice were already evident mid-way through the program. Tina started the program by expressing, “I’m not an expert in anything” (initial interview). Mid-way through the program Tina reported moderate to large increases in her abilities in the areas of active learning methods, and using and selecting educational technology tools (Figure 7-41).

Moreover, the updates to the teaching materials resulted in less administrative work for Tina,

“I think there’s been less confusion because they haven’t been asking as many questions as they usually do. By now, I’ve usually had several questions on the essay and what they’re supposed to do, but I haven’t which is surprising given I’ve made them do a recording. Yeah, I think that they’re probably clearer about what they’ve got to do” (mid-way program interview).

Figure 7-40 Case 6: Changes to the quality of technology integration measured by the Technology Integration Matrix
Tina was also enthusiastic about her plans for the second webinar and requested support to put her students into meeting rooms for small group discussion. Tina’s attitude towards ZOOM had changed. In fact, she was comfortable enough to say,

“When they are listening to you, they’ll know you’re human because you make mistakes. Maybe it makes people feel more comfortable to make mistakes as well” (mid-way program interview).

![Figure 7-41 Case 6: changes in self-efficacy in regards to competences over the course of a semester](image)

**After the PD program**

When asked to reflect on the influence of the PD program on her teaching practice, Tina responded,

“I felt like I knew the students much better, just through listening to their interviews and reading their reflections on each other’s posts [...] we had a lot more contact through the webinars. We kind of have more of a personal relationship. I think that using the webinars and the technology increased my knowledge and understanding of the students themselves” (final interview).
Tina found great value in her experiences with the PD program. When asked to reflect on what kind of advice she would give to a peer struggling with engagement in a fully online subject, she said,

“I do talk to people about the fact that I have the webinar where they have the chance to talk to each other [...] So, yeah I’d say, “Try and get them together”. And I know that some of them [students] did talk to each other using Facebook or something even though they weren’t’ interacting with me. It’s good to know that they had some mutual support and they would have felt supported themselves” (final interview).

Even though Tina still expressed teacher centred views such as, “Well, sometimes I feel I do more work than they do [...] because I want to teach them more” (final interview); Tina had shifted her perspective about her students' abilities and approaches to learning,

“It seems to be that some people come with their own ideas into the course and they just want to consolidate those ideas. Whereas other people come in and they are more open and do change through the materials. And seeing beliefs changing is really what’s important” (final interview).

7.6.6 Case 6 discussion

Teaching and learning in an online context requires different social dynamics, which may influence students’ and teachers’ ability to interact not only with each other but with the content. This context also requires more advanced technological abilities which can cause stress for the teacher or, as in the case of Tina, motivate them to actively seek out PD opportunities due to the discomfort created by low self-efficacy. As a result, this case study suggests that the student vs. teacher centred conceptions of teaching may not be completely applicable in an online context. Tina’s uncertainty about how much content and guidance to provide, or what constitutes quality teacher presence in an online space are indeed insightful. Thus, this case study highlights the need for future research into examining the applicability of Kember (1997)’s conceptions of teaching continuum to an online context.
Nevertheless, if Tina’s online teaching practice is examined using Kember (1997)’s framework, her practice appears to be in transition through the continuum. Note that Tina’s practice started in the imparting information stage. She was a presenter in charge of transferring information to students as passive recipients. The content was completely defined by a curriculum that Tina did not feel in control of. By the end of the PD program, Tina’s teaching practice seemed to have transitioned into the teacher-student interaction stage. Increased communication allowed Tina to see herself as presenter and facilitator of an interactive process in which she is responsible for student’s learning. She was much more comfortable defining the content in a way that could be better discovered by students within a framework she was in control of.

Tina’s positive predisposition towards online learning seems to have influenced her value beliefs around enhancing her technology integration and pedagogical approach. In addition, her motivation to increase online engagement seems to have mediated the utility value of the strategies presented through the PD program, making Tina willing to invest the cost of extended time and effort to redesign her curriculum materials and implement her webinars. Moreover, note how both Tina and Janis’ case studies not only confirm that pedagogical beliefs are directly shaped by the individuals’ own student experiences, but that these beliefs may shape the expectations they have of themselves and their students. In a teaching-learning context, if the teacher is a high achiever by nature, this may cause their inner critic to judge their own performance or their students’ performance harshly. In turn, this may influence their self-efficacy and potentially their teaching performance. It is also noticeable how teachers with high expectations of themselves will expect the same from their students, and this may result in frustration or even friction.

A focus on learning design enabled the adoption of more facilitative and interactive online teaching through strategies such as the webinars, and peer feedback. Increased
interactions seem to have also resulted in deeper learning approaches and engagement from her students.
7.7 Case 7 – Analysis of Findings

7.7.1 Participant description

Karla has over seven years of industry experience and 17 years of teaching experience. She is a veterinarian who works at the university’s animal hospital as a clinical teacher overseeing practicing students. Karla’s teaching load is comprised of undergraduate and graduate small group lectures, as well as the coordination of two fully online subjects. At the time of her participation in the PD program, in addition to being a full-time teaching staff member, she was completing the Graduate Certificate of University Teaching (GCUT) as part of her continuing professional development. Other pedagogical and technological support is provided centrally by the University through consultations with learning designers and workshops.

Karla expressed her motivation to participate in this PD program as follows:

“I would like to improve online teaching, and the use of technology for online teaching and peer to peer engagement. I coordinate a whole online course. One fairly common complaint from students is lack of peer to peer engagement and sometimes peer to tutor engagement also” (initial diagnostic).

7.7.2 Subject Description

The subject is delivered entirely online as part of the Graduate Certificate in Small Animal Emergency and Critical Care. The objective is to introduce students to the fundamental pathophysiological and clinical aspects of emergency and critical care of dogs and cats. There are 20+ students enrolled in the subject. The curriculum follows a case-based learning approach. On a weekly basis, students are expected to read information on a tutorial topic as the main content delivery, then complete a self-assessment quiz, before reading a case study which incorporates another quiz. At the end of the semester, there is a final exam made up of 50 multiple choice questions.
7.7.3 Limitations

An obstacle in Karla’s case is that her faculty mandated the use of a particular online platform for curriculum delivery rather than the University’s endorsed LMS. This means Karla had little control over the way her curriculum was delivered. Karla’s learning designs were copied from other pre-existing subjects created by fellow peers and the platform imposed a specific layout. To be more specific, all assessment tasks are based on multiple choice questions only; there are no discussion forums available or any other communication channels; there is no data accessible for learning analytics; there is no direct communication with her students, as support is offered via email by the managers of the platform and not by the teacher.

In addition, prior to the start of the PD program, Karla made it clear that she could not change her learning designs. This was due to an agreement between the faculty and the provider of the platform, which stated that if any changes to the content were needed, these would be applied by the platform admin staff, not the teacher. For this reason, the focus of the PD was on strategies to increase engagement using tools outside of Karla’s original technical infrastructure. The development of these strategies required time and effort. Therefore, this case study was conducted over a whole year, rather than a single semester. Design consultations took place approximately once a month during the first four months, then via ZOOM, phone or chat. The subject was implemented during the first semester of 2018.

Other critical limitations of this case study included a heavy workload limiting Karla’s time to fully engage in the PD program and the fact that Karla’s faculty is off-campus which presented critical obstacles to face-to-face communication.
The learning design of the subject is displayed in Figure 7-42 and it is colour coded. The solid yellow boxes highlight the sequence of PD activities implemented throughout the semester as part of the PD program. Blue boxes depict self-study tutorials, with self-assessment quizzes that follow in yellow boxes. The green boxes represent practice case studies with multiple choice quizzes embedded in them. The delta symbol in yellow draws attention to changes as a result of the PD program and will be found throughout the text to highlight the nature of the influence of the PD program in the participant’s teaching practice. Table 8-13 provides a description of the subject's objectives and tasks.
Figure 7-42 Case 7: Learning Design Subject 7 including a map of the sequence and influence of the PD program in the participant’s teaching practice
Table 7.13 Case 7: Subject and task descriptions

### Subject 7

This is a fully online unit, part of the Graduate Certificate in Small Animal Emergency Critical Care.

**Subject Overview**

This course focuses on emergency and critical care (ECC) of the dog and cat. The course will cover both the fundamental pathophysiological and clinical aspects of ECC. Specifically, this course will lead to the ability to identify and address life-threatening conditions such as, but not limited to major trauma, toxicities, sepsis, acute abdomen, cardiac failure, respiratory and ventilatory failure, renal failure and urethral obstruction. Students will develop knowledge in the techniques necessary to perform emergency and critical care procedures and develop knowledge in the monitoring of these patients. Students completing this course will gain understanding and confidence when dealing with ECC patients through didactic coursework, use of realistic case studies and assessment that provides feedback and re-enforcement of materials.

**Learning Outcomes**

On completion of this subject, students should be able to:

- Explain the physiological principles underlying major body system homeostasis.
- Explain the fundamental pathophysiology underlying common emergency and critical care conditions
- Correctly interpret clinical signs and diagnostic test as they apply to the assessment of emergency and critical care.
- Create a sound treatment plan for patients with different types of homeostatic and major body system compromise.
- Justify all management decision used for treatment, diagnosis, and monitoring patients with emergency and critical care conditions.

<table>
<thead>
<tr>
<th>Assessment Task (AT)</th>
<th>Description</th>
<th>Timing and grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT1 – Self Assessment MCQs: Following each tutorial, there are 10 multiple-choice questions (MCQ) per tutorial assessment. 2 minutes per MCQ; approximately 20-30 minutes per tutorial assessment.</td>
<td>20%</td>
<td></td>
</tr>
<tr>
<td>AT2 – Case Studies: Interpretation of 25 case studies each assessed by 5 MCQ. 25 case studies. Each case study will take around 30 minutes to complete. Two to three case studies per tutorial.</td>
<td>30%</td>
<td></td>
</tr>
<tr>
<td>AT3 – Final exam: Open-book 50 multiple choice question examination. Total time: 100-200 minutes. Must be completed during exam week at the end of the semester.</td>
<td>50%</td>
<td></td>
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</tbody>
</table>
7.7.4 What I think: individual beliefs

Before the PD program

The experiences Karla had as a student contributed to shaping her pedagogical beliefs. These experiences include passionate, enthusiastic, animated and patient teachers. She also went to university during the 80’s, and she recounts how in those days if a task required the use of any type of technology, all the time was spent figuring out the equipment rather than focusing on the content. Karla reports feeling quite annoyed and discouraged by technology.

These experiences created some student-centred beliefs, but in practice, several of those beliefs are manifested in teacher-centred actions (Figure 7-43). When asked to reflect on the findings of the initial diagnostic, Karla responded,

“Ideals and reality are not always close, to be honest. It is really hard to do [...] The online thing is new. Like I said, it’s a brand new course. So I’m mainly a clinical teacher. So small group teaching, basically. Always done a few lectures and a few tutorials. But the online thing is new. Using technology to teach is new to me” (initial interview).

Interestingly, just like Tina, Karla reports that some of her teacher-centred intentions regard not knowing how much content and guidance to give students in an online context,

“I guess one of the things I need to get right is a balance between the amount of reading that they’re doing online. So, the amount of written material given to them, along with the number of activities or media or other stuff that helps keep things interesting” (initial interview).
During the PD program

Karla's teaching at the animal hospital occurs around authentic cases in a situated context. However, online teaching requires an altered dynamic which may be limiting Karla's teaching approach. A more in-depth understanding of the exact nature of her pedagogical beliefs (Table 7-14) enabled more focused conversations during the design consultations.

Note that Karla has very low beliefs and intentions towards interactive and facilitative teaching (Table 7-14). This may be connected to her own experiences with excessive amounts of information during her lectures at the university. However, her high beliefs and intentions towards the effective transfer of knowledge seem to be fuelled by her beliefs and intentions to motivate students to be successful veterinarians.
Table 7.14 Case 7: Self-reports of change in sub-components of the teacher beliefs and intentions questionnaire

Based on a Likert scale, with a maximum score of 10 except for facilitative teaching which amounts to a maximum of five points (Norton, et. al, 2005)

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* no change *decrease *increase

Karla was asked to describe the learning-teaching process,

"What is learning? Learning is having an experience that builds on what you know. How do they [students] learn best? They learn best by doing meaningful tasks, so meaningful teaching activities that align with certain areas that they’re trying to grasp and areas that they’re trying to build on” (mid-way program interview).

Karla’s epistemological beliefs can be considered highly constructivist. But they still don’t address her ideas around interactive or facilitative teaching. To further explore her views, Karla was asked to describe the teacher’s role in the learning-teaching process,

"The teaching role is to not only provide the task but to guide them [students] as well. And also to provide them feedback on where they’re going, so that when they are learning they have to know more how this relates to where they are going? And how does this relate to what they are trying to achieve” (initial interview).
Karla’s views provided the opportunity for the conversation to focus on guidance as a dynamic exchange of information, in which the student is not a passive participant. Mid-way through the conversation, Karla had the following realization,

“I think that one of the focuses would be to be able to keep relating back what’s being taught to life. So to make it very applicable to what students really want to do with that information. So when they do a subject, they want to learn more about a particular area of veterinary science, but the reason they want to learn more is so they can put it into practice. So I’d probably make it a bit more case-based and get more case discussion in there,” (mid-way program interview).

This self-reflection seemed to help Karla become more self-aware of her online teaching practice, given that she concluded,

“If I was redesigning the tutorials, I would focus more on teaching and learning rather than just presentation and content. I think the subject is a bit content heavy and maybe a little bit textbook-like. And so I would like to try and move away from that and a bit more to teaching and learning activities” (mid-way program interview).

**After the PD program**

The final interview with Karla occurred three months after the last chat interaction held as part of the PD program due to pressures in her workload. The chat interaction regarded Karla’s request to send out a feedback form to students via the online platform, however, this was not actioned by the platform administrators in time. This meant that student feedback could not be collected, and as a result the subsequent evaluation of the subject as part of the PD program was cancelled.

During the final interview, Karla was asked to explain her understanding of the student vs. teacher-centred continuum,

“Student-centred teaching is a type of teaching or a style of teaching in which you encourage students to self-learn, reflect, and have motivation for their own learning. So you provide the platform and students essentially do the learning. Teacher-centred learning is more based on the passive transfer of knowledge
Karla’s explanation didn’t reflect an in-depth understanding of her role in facilitating the teaching-learning process. So, she was asked to describe her own teaching practice in relation to the previous explanation,

“How I see my teaching is I’m very aware of trying to make lectures and my online teaching more student-centred, more active. So I guess the main change for me recently has been with the lectures, just making them more case-based, problem-solving style of lectures and trying to get students more involved in chatting together and coming up with solutions and answering questions and stuff like that. So that’s been the biggest change in my actual lecturing style” (final interview).

Given that there was no class observation or student feedback, Karla’s student-centred claims could not be verified. Changes to her pedagogical beliefs as a result of the PD program (Figure 7-43) do convey a moderate increase towards student-centred intentions, but there was no change in teacher-centred approaches. When asked to reflect on the findings, Karla said,

“I think as you become more and more aware of how students learn and how they’re going to need to continue to learn after their degree, you do realize that’s not about just passive knowledge transfer and regurgitation. Like you get a much better grasp on that. At the same time, I teach veterinary science and we have an absolute requirement for our students to have day one skills and knowledge. Otherwise, our school gets shut down. So we are responsible that every single student that graduates as a vet have a certain body of knowledge and skillset. So I need to be very careful.” (final interview).

It became evident that in Karla’s mind, the regulations imposed on her discipline require a more teacher-centred approach and Karla’s value beliefs are strongly influenced by her organization culture,

“So we need to provide them with guidance as to what’s important to learn. So, we do have to give them a lot of guidance and we have to. We’re regulated. Our degree is highly regulated as to what we have to make sure that they do know when they leave” (final interview).
By the end of the PD program, it almost seemed like Karla’s pedagogical beliefs reverted back to focusing on guidance as delivery of information, and moved her intentions away from increasing engagement and interactivity.

7.7.5 What I know: competencies

Before the PD program

Karla grew up on a farm, and technology did not play a huge role in her upbringing. She did not remember any use of technology for learning prior to university. As a result, she reports low technologically related TPACK components (Figure 7-44). Technological Pedagogical Knowledge is the highest component, but Karla explained that meant using technology for content presentation through the use of videos, rather than engagement.

Figure 7-44 Case 7: Self-reported changes in pedagogical beliefs as measured by the diagnostic instrument by Norton et al., (2005).
Moreover, Pedagogical Knowledge and Pedagogical Content Knowledge are initially low (Figure 7-44). This is interesting given Karla’s extensive teaching experience,

“I’m not completely naïve, but I’m sure I’m not the most knowledgeable person in the world either as far as pedagogy goes. I’m a vet that’s become a teacher, doing tertiary work in academia. Even though I might have been teaching for 17 years, I guess the study of teaching is new to me. Because I wasn’t employed as a teacher initially. Even though I had teaching responsibilities” (initial interview).

**During the PD program**

Pedagogical support for Karla regarded case-based learning and the flipped classroom. This was relevant in light of Karla’s low self-efficacy around active learning methods and the use of cognitive tools (Figure 7-45). Theory on the flipped classroom was used to guide Karla’s competence to implement webinars, which ended up being a central focus of the PD. From a technological perspective, in order to enhance engagement, the focus was on teaching Karla how to use ZOOM for webinars, Google Hangouts as a communication channel and PollEverywhere to triggering conversations around cases.

![Figure 7-45 Case7: changes in self-efficacy in regards to pedagogical knowledge over the course of a semester](image)
After the PD program

In spite of the obstacles, the PD seems to have had an influence on Karla’s knowledge and competencies. Notice the large increase in Pedagogical Knowledge and Pedagogical Content Knowledge (Figure 7-44). Karla’s reflection on these findings regard a new awareness of how to overcome the challenges of the dynamics online,

“I’ve become far more aware of really the need to have some sense of community to teach successfully online. So I’m far more aware of that than I used to be and my knowledge as to what tools I can use has increased a lot in the last year as well” (final interview).

Upon deeper analysis to identify the nature of these changes, it is believed that what is reflected here is Karla’s increased confidence in her own Pedagogical Knowledge. This is further supported by large changes in self-efficacy related to active learning elements (Figure 7-45).

In addition, there was a moderate increase in Technological Content Knowledge, Technological Pedagogical Knowledge and TPACK (Figure 7-44). However, this change was not reflected in Karla’s self-efficacy around using cognitive tools (Figure 7-45). Nevertheless, Karla reports,

“I have increased my confidence in being willing to drive different technologies to try and improve the quality of teaching. That’s definitely changed I think a lot since I’ve met you first. I’m still not super confident” (final interview).

These findings are further supported by an analysis based on the Technology Integration Matrix (Figure 7-46). The findings indicate no change in the quality of technology integration in Karla’s curriculum.
Figure 7.46 Case 7: Changes in the quality of technology integration based on the Technology Integration Matrix

7.7.6 What I do: teaching practice

Before the PD program

Karla reported that her initial curriculum design focused on content presentation. Primarily, she was concentrated on writing up booklets that were uploaded as PDFs to the platform as tutorials and on creating multiple choice quizzes,

"Yeah, it was rushed, the whole curriculum design. I had set deadlines [...] and so the format was already there, and I've had a lot of IT assistance. It is just knowing what works as far as learning goes. And I had to learn things like how to format videos or just how to ... even formatting all the images and stuff like that, that's been a hard learning curve... the media content of my course is pretty gruff: I think there's a lot of room for improvement" (initial interview).
Even if none of the content could be updated, the approach was to improve the supportive materials such as the student handbook, the welcome email, as well as a series of engagement strategies to trigger critical discussion using PollEverywhere and Google hangouts. These updates presented the opportunity to talk to Karla about learning design concepts. Such process was relevant given Karla's initial self-efficacy in regards to competencies around active learning and selection/use of educational technology (*Figure 7-47*).

![Figure 7-47 Case 7: changes in self-efficacy in regards to competences over the course of a semester](image)

During the PD program

The first step in this collaborative design process was to improve the welcome email. This email was full of unnecessary links for external services provided by the platform, and it had insufficient instructions on how to use the platform. The welcome email was rewritten to highlight login credentials and provide step by step information on how to navigate the platforms. It also included supportive materials for the tutorials and user guides. Karla sent out the email with an updated version of the student handbook attached to it from her own email account.
The handbook was also reorganized to include an introduction to the subject, to outline clear communication channels for support, as well as, to provide step by step instructions on how to study the subject week by week.

The proposed engagement strategies that Karla thought relevant to her curriculum included the implementation of webinars using ZOOM; using Google Hangouts to offer “office chat hours”, as well as to implement “reflection stations”. These reflection stations involved sending case studies on a biweekly basis to entice online discussion through the chat. PollEverywhere was also considered useful to increase participation and interaction through polls.

During the first four months of Karla’s PD, 15 minutes of every design consultation were allocated to help Karla prepare some initial tasks to use with her students. One design consultation was devoted to coaching Karla to access Google Hangouts; to create groups for her subjects, and to send out invitations to students to join the chat. Polls were also created in PollEverywhere to use as icebreakers.

Another face-to-face design consultation was devoted to the methodology around webinars. She was shown video samples and was provided with a blueprint and guidance to plan her first webinar. Another design consultation focused on hands-on practice with the functionality of ZOOM through role-play scenarios. In addition, after the start of the semester, once Karla’s workload got heavy, two design consultations took place using ZOOM as an added hands-on-practice.

Mid-way through the program, Karla seemed motivated and enthusiastic about implementing her webinars but was hesitant due to time constraints,
“I think that it is evolving. I think I’ve got a much greater kind of understanding of what needs to be done. However, the actual changing of the course to improve it is extremely time-consuming. And what I want to achieve and what I can achieve are not necessarily the same thing. So, I think it’s a work in progress.” (mid-way program interview).

Two months into the first semester of 2018 Karla’s workload got heavy, and she no longer had time to engage in face-to-face design consultation. A more limited form of support continued via phone and chat. But as will be seen, this created critical obstacles to successful PD outcomes.

**After the PD program**

When Karla was asked to reflect on the influence of the PD program on her own teaching practice, she said,

“So definitely when we first started and went over the initial communication, which that information evolved to having me produce a handbook. I think that was really, really helpful just to have that outside perspective, fresh eyes, and the feedback. The other standout thing was just going through and practicing the different technologies and learning about what options were available. Even though I’m not super confident with those, I’m a lot more confident than I would have been otherwise” (final interview).

However, none of the engagement strategies that were prepared actually got implemented. In terms of the idea to use Google Hangouts to offer ‘office chat hours’ or trigger critical conversation around case studies, Karla explained,

“The big hurdle I had was trying to access the student email addresses. When we tried to set up Hangouts, I was very enthusiastic about it, followed all of the steps, wasn’t hard to do. The reason it didn’t work is that I couldn’t actually get the correct student email addresses. And my hands are tied, because even with IT […] they did not send me the correct addresses. So all the work they did to try and set it up was wasted time. So that’s a huge frustration” (final interview).
It soon became evident that this experience may have demotivated Karla from trying to implement her webinars and use her polls. When she was asked what had happened, her response was “time” (final interview). Later in the interview, she was asked to reflect on the same issue but from the perspective of providing recommendations for improvement of the PD,

“To schedule time to implement the different ideas. So that’s probably the thing that I would change the most is that I struggle to find the time to actually implement what I wanted to. So, if that time could be rescheduled out of regular work, that would be best because I think then you get more out of the program [...] rather than just having the ideas” (final interview).

Note how as a result of the disconnect in the PD and unsuccessful implementation of the strategies, Karla’s self-efficacy went back to what was initially reported for use of technological tools and implementation of tasks (Figure 7-47).

Still, a positive change in Karla’s practice is a newly found confidence to take control over the communication with her students,

“I think it [this PD) has challenged some traditional thinking and some, like the way the whole course is set up and the platform was used. I’m more confident in actually challenging that, whereas when I first set it up, of course, I was told, ‘this is how it is going to be’. There wasn’t much flexibility and having spent time with you [the researcher], I feel more confident to actually challenge that and to try to initiate change, albeit slow, but just to chip away and try to improve things” (final interview).

As a result, Karla’s future plans for her subject included taking over email communication right from the start. She planned to send the welcome email and request students to confirm their email addresses. She would also attempt to engage students in conversation using Google Hangouts, review the objectives of her subject, entice more reflection by including more video or podcasts into her content, and finally try to implement webinars using ZOOM.
7.7.7 Case 7 Discussion

In spite of concerns raised in case 6 about the suitability of using Kember (1997)’s conceptions of teaching continuum in an online context, Karla’s teaching practice can still be identified in the imparting information stage. She was initially concerned with presenting content to students as passive recipients. She tried conveying her knowledge, but her learning designs were limited by the affordances of the platform. Unfortunately, given all the aforementioned limitations, there were no visible changes in Karla’s teaching practice.

In this case study, it became evident that if aspects of organizational culture present critical concerns to teacher’s agency, the possibilities of effective PD outcomes are limited. Karla’s limitations concerned faculty standards to training students for jobs, high workload, lack of control over curriculum and technical infrastructure, and insufficient support by administrative staff of the platform. Such limitations seemed to have impacted Karla’s motivation, decreased her sense of value of the innovations presented by the PD influencing her willingness to invest time cost involved. Ultimately, low control beliefs affected self-efficacy and pedagogical beliefs to the point of reverting back to initial reports.

Karla’s experience supports the argument that awareness alone does not directly lead to any changes in practice without sufficient support and adequate time to have successful experiences with educational technology. Karla’s final suggestion for more engaged support during the implementation of strategies may be a worthy consideration for PD programs. This is especially true for teaching staff that hold very traditional/teacher-centred approaches. The altered dynamics of the online context require more flexibility and creativity which may be limited in traditional approaches without the proper support. So the elements of collaboration and careful consideration of technical infrastructure upon which this PD program was designed is highly relevant to ensure quality online teaching and learning in this context. Moreover, using an assessment instrument to get insights into a
teacher’s pedagogical beliefs and competencies would also be important if higher education institutions are aiming to support growth and innovative practices.

Finally, this case study provides some insights into PD considerations to support online teaching and learning. First, it is important to support the teachers learning design competencies, especially when it comes to finding a balance in the amount of content and the guidance provided to students. It is often assumed that students know how to study online which may not be true. Moreover, due to the lack of face to face interactions, formative and summative evaluation become even more relevant. Supporting teacher’s ability to evaluate their own subject is likely to have a profound influence in the quality of teaching practice.

7.7.8 Refinements to the PD program after the second iteration

Following the guidelines of DBR, the researcher evaluated the effectiveness of the PD program after each iteration. This process allowed to identify possible refinements to the PD program prior to the next implementation.

After the second iteration, it was observed that the strategy of allocating ten minutes of each design consultation to discuss technological possibilities was still not fully effective. As a result, the PD was refined to use ten minutes of each design consultation to support participants through hands-on-practice activities with one or two technological tools that were considered relevant to their curriculum. No other technological tools were introduced until the participant reported having successful experiences with them.

The class observation also continued to be reported by participants as a powerful and in-depth reflection exercise. Consequently, the third iteration involved two class observations instead of just one. One class observation took place at the beginning of the semester and
the second one near the end. This allowed a pre-post comparison of performance using the Technology Integration Assessment Instrument (TIAI).

In addition, it was also observed that not enough emphasis was given to formative evaluation. Therefore, the design consultations were refined to help participants identify all of the ‘signs’ of student learning or opportunities for improvement throughout the semester.
7.8 Case 8 – Analysis of Findings

7.8.1 Participant description

Julia has five years of law practice and six years of teaching experience. Because of the nature of the discipline, the law faculty is known for having a unique approach to teaching. For instance, unlike other faculties of this institution, the law faculty decided to limit the use of the LMS, which is controlled by a central team of LMS administrators and not the teaching staff members themselves. This team of learning designers is in charge of managing and uploading all the content. As a result, LMS use by staff and students is limited to being a repository of readings, a communication portal to send out announcements and as a submission tool for assessment tasks.

Professional development support is also provided in-house. The law faculty selects a number of academics to serve as teaching and learning champions. These champions are chosen because their approach to teaching is considered effective and appropriate. These champions become advisers to all faculty members who may seek out support. Job promotions for teaching academics within the faculty are granted based on academic publications, but peer review of teaching is also considered.

Julia explained that during her entire teaching career, she had been focusing on enhancing her publication record, which overshadowed any opportunities of PD. This lack of PD created some discomfort, guiding Julia to express her motivation to participate in this PD program as follows,

"I teach seminars of 60 students in a subject that has a reputation for being difficult. There is a widespread of ability and I tend to teach to the lowest denominator, which means I tend to lecture in order to cover all of the materials so that the poorer students keep up. This bores the better students. Students generally view me as a caring but boring teacher” (initial diagnostic).
7.8.2  **Subject description**

This subject is part of the graduate law degree. It is concerned with the legal rules, practices, and institutions directed at ensuring that public power is exercised according to the law. The subject follows a case-based learning approach and involves one practical assessment task and a final examination. Students attend two-hour lectures twice a week.

There are approximately 240 students in the cohort, but the subject is broken into 4 different groups of 60 students each. Julia is one of four teaching staff delivering the same content. From the beginning, this presented a limitation to the PD program as Julia made it clear that she could not change any of her learning designs or instructional materials, given that all teaching staff members in the subject needed to teach the same content. The only thing she could control was how her lectures were delivered, and that became the focus of the PD.

The learning design of the subject is displayed in Figure 7-48 and it is colour coded. The solid yellow boxes highlight the sequence of PD activities implemented throughout the semester as part of the PD program. Blue boxes present lectures, with one invited speaker represented in yellow. The ovals represent a practical report and a final assessment. The delta symbol in yellow draws attention to changes as a result of the PD program and will be found throughout the text to highlight the nature of the influence of the PD program in the participant’s teaching practice. Table 7-15 provides a description of the subject’s objectives and tasks.
Figure 7-48 Case 8: learning design subject 7 including a map of the sequence and influence of the PD program in the participant’s teaching practice
### Subject 8

This is a core unit of the Graduate Law Degree.

**Subject Overview**
This subject concerns the legal rules, practices, and institution directed at ensuring that public power is exercised according to law. For this reason, this topic is at the coal-face of the legal relationship between the government and the people. This subject encompasses both judicial and non-judicial modes of accountability. It also is primarily about reviewing the exercise of power by the executive branch of the government.

**Learning Outcomes**
On completion of this subject, students should be able to describe:
- The structure and operation of executive government in Australia;
- The fundamental principles of effective governance and accountability for the exercise of government power;
- Some theoretical perspectives on administrative law, including the relationship between administrative law and governance and the foundations of judicial review;
- The structure and operation of the Australian administrative law systems, including their constitutional, statutory and common law bases, institutions, principles, and remedies;
- The importance of statutory construction and interpretation in the exercise and supervision of government powers, and the major techniques and aids used;
- The way in which government policies are given effect through legislation and how the legislative and administrative law framework affects their implementation;
- The primary aspects of practice and procedure in administrative law; and
- Challenges to the development of administrative law and accountability in Australia today.

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<th>Assessment Task (AT) Description</th>
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<td>AT1 – Practical Exercise: students are handed one question concerned primarily with statutory interpretation of the law. 1250-word essay.</td>
<td>Due week 6 - 20%</td>
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<td>AT2 – 3 hour supervised examination: This is an open book examination. The exam allows for 30 minutes of reading time and 3 hours of writing time. It is held during the examination period under supervised exam conditions.</td>
<td>Due week 12 - 80%</td>
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7.8.3 What I think: Individual Beliefs

Before the PD program

Julia attended a Catholic school and she recalls some of the nuns being very strict and boring as teachers. Later on in university, she had some negative experiences with male lecturers who were “bigger than life characters always talking about themselves” (initial interview). Some positive experiences involved teachers who were caring, warm and would treat students as equals. She also remembers small group discussion and group work as effective learning strategies. These early experiences shaped Julia’s pedagogical beliefs. Note her high student-centred beliefs and intentions (Figure 7-49). Still, there are some knowledge transmission tendencies which caused an uncomfortable self-perception, “as a teacher, I think I’m caring but boring” (initial interview). Moreover, her self-efficacy was affected by a fear of insufficient knowledge in some aspects of law,

“So I find myself in a situation. If I know the content, then I am more confident and willing to let go. But if I am not an expert in what I am teaching … for instance, with property law, I was only two lectures ahead of my students, and often I would try to deliver all the information hoping that they wouldn’t ask any difficult questions. I often find myself worrying about how much content I need to cover” (initial interview).

Figure 7-49 Case 8: Self-reported changes in pedagogical beliefs as measured by the diagnostic instrument by Norton et al., (2005).
During the PD Program

In order to support a change in beliefs, it was considered critical to help Julia change the perception of her own teaching, but also improve her self-efficacy. Note how Julia’s beliefs in teaching as an interactive process and her role in motivating students are lower than her intentions (*Table 7-16*). Instead, her displayed classroom behaviours were infused by a tendency for knowledge transmission (*Table 7-16, knowledge of the subject*).

To better understand the nature of her beliefs, Julia was asked to explain how she thought her students learned best,

“I think [learning] it’s something you didn’t know before. [I know they learned] By doing, that’s the best way. By what they tell me in class, so answers to my questions and to the kind of questions they’re asking, and then at the end, the exam, obviously” (*mid-program interview*).

*Table 7.16 Case 8: Self-reports of change in sub-components of the teacher beliefs and intentions questionnaire*

Based on a Likert scale, with a maximum score of 10 except for facilitative teaching which amounts to a maximum of five points (Norton, et. al, 2005)

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Just like her pedagogical beliefs, Julia’s epistemological beliefs expressed both constructivist tendencies through learning by doing, but also traditional assessment strategies based on recall. To help Julia become self-aware, she was asked to
consider how her belief in learning by doing was manifested in the final exam. This question triggered the following realization,

“There’s doing an assessment and there’s doing practice. Partly the anxiety of sitting down with the client... there’s a technique you have to know. It’s about knowing the law, but there are all sorts of other parts [...] like what do you communicate to a client and how. What is assumed, what is something you actually have to argue in practice and it’s very hard for them to know until they actually get into practice” (mid-way program interview).

This realization became a focus of conversation throughout the design consultations. The attempt was to help Julia understand that she could not cover all of the legislation she wanted to teach. For instance, some legislations contained over 1000 pages of information each, and she had to cover several legislations in the subject. This is exactly what was making Julia feel overwhelmed and insecure. Instead she was urged to realize that students needed to learn how to think and communicate like a lawyer; how to develop the skills to search and find the pieces of legislation needed at the right moment; and that this is something she possessed based on her law practice, which she could give her students regardless of the type of law she was teaching. This thought motivated Julia to experiment with pedagogical approaches. In fact, halfway through the semester, Julia reported that she was so passionate about transferring the practical skills associated with her discipline, that she had agreed to become an academic mentor for students in her faculty.

After the PD program

By the end of the PD program, Julia reported two profound changes to her pedagogical beliefs. The first one regarded a more confident and focused approach to her role as a teacher,

“It was very useful when you said that it was about telling them how, not what, and I think I never really thought of it in that way. I think before, I always thought of teaching as, ‘Now I have to tell you what I know, what I’ve worked out’, but that is not the case. What I need to tell them is how I worked out what the ‘what’ is” (final interview).
This change was not only noticed but really appreciated by her students who reported,

“It really helped me understand how to actually approach these problems in a way that was holistic and complete. Whereas other classes I don’t feel like I get that level of ‘here’s what you actually need to do to understand how these issues are resolved” (Student 2, focus group).

“And she didn’t make it like ‘this is how you should do it’. More like, ‘this is how I would approach it’” (student 1, focus group).

Moreover, as will be described in the next sections, this iteration of the PD program included two class observations instead of one. This resulted in a shift in Julia’s self-perception,

“I guess another realization is that I’m not one of those people who teach with a lot of energy. I’m not a performer in the same way that some sort of entertaining teachers are but that’s okay” (final interview).

Julia also reported a change in her understanding of the difference between student and teacher-centred approaches,

“Student-centred means that they [students] are taking responsibility for their own learning and trying to work out the content themselves before it’s been told essentially. And teacher-centred... it’s this rocking up and reading out your notes and conveying knowledge without any sense of what’s been learned I guess” (final interview).

By the end of the PD program, Julia’s student-centred beliefs and intentions remained high, with a large percentage of teacher-centred beliefs and intentions (Figure 7-49). Julia’s reflected by saying,

“The trouble is that law is a really hard subject, and you really do have to understand what you’re teaching. And I suppose, well you don’t have to teach content but you do have to teach the skills to enable them to work out what the content is, and so I still see that as me transferring knowledge. My sense is that I have to transfer skills, I have to ultimately be able to explain very difficult political concepts, but I’m not saying that has to be done by me standing up in front of the classroom. It can be done through class discussion as long as the content is being
transferred. I don't know, I definitely believe that there's still a transfer of knowledge that occurs from my brain and experience to theirs, but it can’t necessarily come from sitting and doing the reading “(final interview).

7.8.4 What I know: competencies

Before the PD program

Julia's technological competencies were limited to writing on Microsoft Word, navigating the web and sending emails, “You have to understand that my mother was a single parent, and besides a TV we had no technology in the house. So, I think in the end that didn’t influence my current practice. If anything, it is the lack of exposure to technology while growing up that makes a difference” (initial interview). This may be the reason why all Julia’s technology related TPACK components are low (Figure 7-50). Moreover, Julia explained the nature of pedagogical Technological Knowledge as,

“So, I use PowerPoint to deliver. LMS to communicate. The grading is done by hand, given that for privacy purposes, we cannot know the name of the person that does it. So the test is a three-hour long take-home test. They submit it through the LMS and we grade them” (initial interview).

Figure 7-50 Case 8: Self-reported changes to TPACK competencies. as measured by the TPACK assessment instrument by Schmidt et. al, (2009)
When Julia was asked to reflect on her Pedagogical Knowledge, she provided insights into the influence of organizational culture on individual PD,

“I’m actually surprised that it came out as average [72%, Figure 7-50]. I don’t consider myself a very good teacher. See, here you have to also take into account the expectations of the university. As a junior academic you are judged based on your publications, not on your teaching. So when you start, you tend to put more attention to publishing articles, but now I find myself more in balance and I can start focusing on my pedagogy” (initial interview).

Julia’s self perception is also reflected in her low self-efficacy reports in terms of active learning elements and the use of cognitive tools (Figure 7-51). To support his process, the PD program was adapted to include two in-class observations. The intent was to allow for more reflection based on actual performance.

**During the PD program**

To support Julia’s ability to implement a more interactive and facilitative teaching approach, the pedagogical focus was on case-based learning, peer instruction, and the flipped classroom. The PD strategy was based on redesigning the first five lectures of the semester in collaboration. Peer instruction strategies were useful to help Julia to introduce a topic in a manner that would engage students in critical discussion. The flipped classroom was also instrumental to help Julia base lectures
on relevant judicial cases. Julia was advised to conclude each lecture by highlighting readings and self-assessment questions which were included in the subject outline to help students prepare. She was also supported to think of critical questions to help students’ self-assess at the beginning of each lecture through the use of polls.

To complement this pedagogical approach, Julia was introduced to the polling tool Poll Everywhere not only to facilitate peer instruction but also as a formative assessment method to help keep students accountable for their preparation for each lecture. To avoid overwhelming Julia, the strategy was to wait until she felt comfortable with one tool before introducing another.

Mid-way through the semester, Julia reported that she had tried to use Poll Everywhere in class, but the technology had raised an issue of equity. She explained how not all students had a device in class. Julia’s argument was that the institution was non-proletariat by using a teaching tool that required students to have a device in order to participate. After this, all conversations about technology faced this argument. However, this was in direct contradiction to the information provided by the students during the focus group, who actually wished technology was used more, especially when it came to practice quizzes and exams to help them self-regulate and self-assess.

**After the PD program**

There were reports of large changes in Technological Content Knowledge, Technological Pedagogical Knowledge, and TPACK (*Figure 7-50*). Additionally, there was a very large increase in Julia’s self-efficacy in terms of knowledge to use cognitive tools, as well as active methods (*Figure 7-51*). However, Julia was not observed using technological tools in class during the two class observations. Julia was asked to reflect on these observations,
“I mean, PollEverywhere… I just feel like it was not the right use of technology for this faculty. Just because not everyone wants to bring a laptop in and then using phones just didn’t appeal to me. And I guess because I’m a bit of a Luddite. I like the idea of using technology as a means of communication and as a means of enhancing what goes on outside the classroom. If everyone came in with a laptop and they were all comfortable using technology, then I’d be happy to use it but that’s not my sense” (final interview).

This statement provides evidence of Julia’s value beliefs, which seems to suggest that finding technology interesting is not the same as finding it valuable to teach a discipline. Julia was observed in the classroom using active learning methods, but they were adapted to her pre-existing technological abilities,

“What I took away from PollEverywhere is that you can still do a lot of what PollEverywhere does, you just don’t use technology. You kind of use older technology like putting things up on a PowerPoint to engage them. So, you have a quiz but it’s more like questions put up on a PowerPoint to enhance them” (final interview).

These reports were corroborated by an analysis based on the Technology Integration Matrix (Figure 7-52). The findings indicate no change to the quality of technology integration in Julia’s assessment tasks. The one blue dot in Figure 7-52 indicates that Julia’s tasks and lecture style did not reflect changes.

![Figure 7-52 Case 8: Changes in the quality of technology integration based on the Technology Integration Matrix](image-url)
This resulted in Julia’s somewhat enhanced teaching methods being reflected in a large increase in Pedagogical Knowledge and Pedagogical Content Knowledge (Figure 7-50),

“Yeah, I think it does represent my learning over the semester, and I certainly agree that my Pedagogical Knowledge definitely increased and that was essentially about the methods that we discussed in terms of how you connect that knowledge. Or how you encourage learning” (final interview).

7.8.5 What I do: teaching practice

Before the PD Program

When Julia was asked to reflect on the impact of her self-perception as a boring teaching, she explained,

“The way that impacts my practice is that I’m aware of myself. I have this self-awareness, and I know that when I find myself behind the podium, and the students are scribbling away, sometimes I keep on delivering because I am aware that maybe I am boring but I have a lot of content to pass on. So in those situations I just tell them that we have a lot to cover and very short time, so just bear with me. But when I don’t know the subject and I feel uncomfortable, I make the decision to just get it out there as best I can” (initial interview).

Without the ability to alter any instructional materials, the PD program needed another methodology to influence change. Especially, in light of Julia’s low self-
efficacy in her ability to use active learning methods and educational technology tools (Figure 7-52).

**During the PD program**

Given Julia’s lack of control over the instructional materials of her subject, design consultations focused on lesson planning in collaboration and reflections on in class performance. Lessons were structured to begin with an essential question to get students to think about the topic and recognize its relevance. Then, strategic questions were identified to get students to engage in the discovery of the law principles around key judicial cases. Initially, Julia was enthusiastic, “the feedback is that students are happy” (mid-way program interview). This was supported by students expressing how much value they found in the approach,

”... some of the practical skills that we get in class I think were really useful. For me, that was the best engagement. And I think that helps you learn more. And this is the only class that I’ve actually had that done, and for me, the learning process comes in the application of the concepts”(student 1, focus group).

By reflecting on the video recording of her in class performance, Julia was able to observe how knowledgeable she portrayed herself to be. She observed how even the students who had difficulties speaking English were participating. Instead of using PollEverywhere, she had included critical questions in her slides and would give students a couple of minutes to review and discuss the case to be better prepared for small group discussion. She also reported that an increased number of students were approaching her with questions after class or where sending reflections via email. All of this resulted in an enhanced quality of fit, in the first observation (Figure 7-54). As a result of this experience, Julia felt more confident in her teaching performance and she started inquiring about the possibility of requesting peer review of teaching to support her application for promotion.
However mid-way through the PD program, Julia became aware that her new approach differed greatly from the three other academics teaching the same subject, “We’ve just learned along the way, and that could mean slower because I’m now behind everyone else” (mid-way program interview). This created anxiety in Julia, who constantly voiced that there was too much content and too many cases included in the curriculum. Given that she was not in charge of the curriculum, the pressure, and fear of not being able to deliver as much content as her peers gave her so much discomfort that she reverted back to her initial teacher-centred behaviours in the second half of the semester. By the second class observation, Julia was able to observe how she talked at students for over 40 minutes. Students were disengaged. She had chosen not to include any more critical questions in her slides, which meant that instead of having students verbalize the meaning of each legislation or case, she would just tell students what the meaning was. In light of this change in behaviour, the conversation during the design consultation focused on helping Julia realize that she had enough information to decide what type of teacher she wanted to be. She was asked to further reflect and feel empowered in her decision.
After the PD program

By the end of the PD program, Julia had plans for the subject in mind, but was conflicted about how to make them happen given what she perceived as constraints of her organizational culture,

“The key driver for students appears to be old notes and a mythology about how you’re supposed to respond to the ministry of your exam. So, first of all [we] need to redesign the course and the exam […] basically interrupt the formula, and because you don’t get promoted based on teaching, so for me to decide to try and… I mean I’m stuck. Someone has to make those significant changes and you can only really do that if you put your hand up and say, ‘I’m going to convene the course and in two weeks it’s going to be a different one.’ But depending on whether the faculty gives you that extra teaching time, if you’re dedicating your intellect to good teaching, you don’t have time to dedicate your intellect to writing and research and you won’t progress in your career” (final interview).

Julia’s self-efficacy seems to have had a large increase in relation to active learning methods (Figure 7-54). In fact, when asked to reflect on the influence of the PD program on her pedagogical practice, Julia said, “For me, the big leap wasn’t in knowing what’s out there. It was the confidence to apply it and understanding why” (final interview). There was also a moderate increase in terms of using and selecting technological tools, “I’m confident that if I wanted to use a particular sort of technology and I was given the resources and the time to do it, then I could do it” (final interview).

Besides an increased confidence in her own teaching practice and a shift in her self-perception, Julia describes a positive influence of the PD program as follows,

“So coming here and explaining to me the different methods and the reasons why they are considered best practice was very useful, and sitting in my classes was very useful for a range of reasons. The first being when you have someone sitting in to see whether or not you are making the changes, you do it. You don’t put them off because you’ve undertaken to do it for a second person. So, that was really probably the keenest driver for me. It was just very useful having a second person coming and saying ‘you are doing the right thing’” (final interview).
It is interesting to note that in Julia's reflection that she appeared to be implementing the agreed strategies out of a sense of accountability. Her motivation was no longer expressed as a desire to change to improve her practice but as a responsibility to do as agreed with another.

7.8.6 Case 8 discussion

Julia's teaching practice can be positioned within Kember's (1997) conceptions of teaching continuum. She began the PD program in the imparting information stage. This manifested in a concern over being a presenter of information that students would absorb as passive participants. The content was defined by a curriculum she was not in control of, and she experienced discomfort at having to appear as an expert in certain types of law that she was not familiar with. Halfway through the semester, Julia's classroom behaviours resembled the teacher-student interaction stage. Julia appeared to be both presenter and facilitator for students who were active participants in an interactive process. Even if the curriculum was beyond Julia's control, she focused on creating spaces for critical discussion during lectures. Unfortunately, due to fears of falling behind her colleagues in the delivery of the curriculum, Julia reverted back to the initial imparting information stage. It seems that lack of control and autonomy, as well as contextual pressures, have pushed Julia back along the continuum towards teacher-centred approaches.

Making explicit Julia's pedagogical beliefs resulted in self-awareness that enabled her to change her self-perception as a teacher. Moreover, by challenging her epistemological beliefs, Julia realized she possessed the soft skills her students needed as future lawyers. Such realization facilitated a willingness to increase her Pedagogical Knowledge, resulting in an increase in self-efficacy. At the same time, this seem to facilitate deeper learning and engagement by students.
The PD program, however, did not impact Julia's use of technology for teaching. In fact, she improved lesson plans but adapted them to her pre-existing technological competencies, (the use of PowerPoint and email). Moreover, Julia’s argument that the use of technology in-class raised an equity issues, may in fact be masking her anxiety and low self-efficacy in relation to her technological abilities. The fact that Julia described herself as a Luddite during the final interview provides insights into her value beliefs around technology.
7.9 Case 9 – Analysis of Findings

7.9.1 Participant description

Mario had an extensive career as a political campaign manager prior to becoming an academic. He had 18 years of teaching experience and is considered a mentor to his peers within the business faculty. Professional development for Mario is provided in-house and includes consultations with learning specialists and learning designers, peer review of teaching, as well as workshops from external providers of technological solutions.

Mario has advanced competencies with a range of educational technology tools but is not as confident with Pedagogical Knowledge. He explained, "It's not so much the technological support I'm after, it's making sure that the way I am using technology is pedagogically sound" (initial interview). As a result, Mario expressed his motivation to participate in this professional development program as follows,

"[I would like to improve] blended learning to remove the dry content from the classroom to give me more time to show how to apply the content, [which is] the key of the subject" (initial diagnostic).

7.9.2 Subject description

Subject 9 is a core unit of the Master degree in Accounting. The aim of the subject is to familiarize students with the key business processes underpinning organizations. It focuses on the role and operation of accounting information systems. There are 250+ students in the cohort. The subject follows a case-based learning approach and incorporates two main assessment tasks and a final exam.

The subject is divided into two sections. The first part of the semester follows a lecture mode focused on the delivery of core content. During this section, there are
two lectures delivered a week. In the second section of the semester the lectures are replaced with interactive tutorials which include a game-based component that is intended to simulate the management of sales processes in the real world.

The learning design of the subject is displayed in Figure 7-55 and it is colour coded. The solid yellow boxes highlight the sequence of PD activities implemented throughout the semester as part of the PD program. Blue boxes present lectures, the green boxes group tutorials which include a game-based component in yellow. The ovals represent assessment tasks. The delta symbol in yellow draws attention to changes as a result of the PD program and will be found throughout the text to highlight the nature of the influence of the PD program in the participant’s teaching practice. Table 7-17 provides a description of the subject’s objectives and tasks.
Figure 7-55 Case 9: Learning Design Subject 9 including a map of the sequence and influence of the PD program in the participant’s teaching practice.
Subject 9

This subject is a core part of the Master degree in accounting.

Subject Overview
The aim of the subject is to familiarize students with the key business processes underpinning organizations. It focuses on the role and operation of accounting information systems. Flowing out of this is the opportunity to revitalize business processes, improve business decision-making, and gain competitive advantage.

Learning Outcomes
On successful completion of this subject, students should be able to:
- Explain how strategy influences the need for business process information;
- Identify and describe generic business strategies
- Explain the association between strategy choice and business processes
- Explain the role of business process information in assessing strategy
- Interpret business process documentation;
- Prepare plans to achieve an adequate level of internal control;
- Describe and evaluate business processes
- Order entry / billing / accounts receivable / Cash Receipts
- Purchasing / Accounts Payable / Cash Payments
- Non-Routine Processes
- General Ledger and Financial reporting
- Conversion
- Evaluate, analyse and interpret the efficacy of business processes and their related enterprise information systems.
- Explain how business process information is used to measure enterprise performance

Assessment Task (AT) Description

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<th>Assessment Task (AT) Description</th>
<th>Timing and grade %</th>
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<tr>
<td>AT1 – Peer Assignment: This task includes two questions based on case-based scenarios and two questions based on theory. Students are required to answer only two of the questions in 300 words or less each. In addition, students are required to provide peer feedback to at least 2 more peers.</td>
<td>Due week 4-5 -10%</td>
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<tr>
<td>AT2-Group assignment: Students are provided with an authentic scenario. In groups of five, they have to come up with recommendations for improving the operational processes of that business. Students are required to write a 500-word presentation brief and prepare a 10-minute presentation for a panel of expert academics on the topic.</td>
<td>Week 11 – 30%</td>
</tr>
<tr>
<td>AT3 – Final exam: Students are provided with five authentic scenarios. They have 3 hours to analyse, troubleshoot and provide recommendations to the operational processes of each business.</td>
<td>Week 12 – 60%</td>
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7.9.3 What I think: individual beliefs

Before the PD program

Mario’s pedagogical beliefs are somewhat influenced by his experiences as a student. He recounts positive experiences with teachers that were very thorough and often teacher-centred, but who challenged his ideas respectfully and gave useful feedback. Some negative experiences include inflexible, close-minded teachers who disdainfully used educational technology only because it was a requirement.

Mario’s pedagogical beliefs were also influenced by his extended political experience which taught him the importance of discussion and communication. His upbringing also had an impact. Mario grew up surrounded by technology, from when he bought his first Atari at an early age, gaming became a passion. His high exposure to technology often made him more technologically savvy than his teachers, and he often found this frustrating. Mario recounts how information processing, building databases, or e-business reports were his favourite tasks in university. These experiences shaped Mario’s high learning facilitation beliefs and intentions (Figure 7-56). Still, there was a high percentage of knowledge transmission tendencies. When asked to reflect on his understanding of student and teacher-centred approaches, Mario responded,

“Okay, student-centred I see as more trying to get students to pursue their own learning, whereas the teacher is more the facilitator; teacher-centred it’s more about a stand, literally. Stand in the approach where the teacher is the center of it all” (initial interview).

Mario was also asked to reflect on the findings of the initial assessment instrument (Figure 7-56). Interestingly, he responded that his teacher-centred approaches were manifested by design,

“Being in lecture mode, I do try to get interactive and facilitate participation. The lecture by nature is always going to be a bit more teacher-centred, whereas that second half, the seminars is with small cohorts, I want that to be more student-centred. In some ways, yeah I am teacher-
centred but some of that was actually a conscious choice, so I could be more student-centred elsewhere” (initial interview).

One of the biggest challenges perceived by Mario is the fact that 95% of his students are international students whose first language is not English. This presents language barriers, which affects participation and other issues, for example:

“Probably one of the biggest challenges we have in accounting, which makes accounting a bit different to other disciplines is that so many students study accounting for permanent residency reasons. They don’t study accounting because they want to be accountants, they study accounting because it’s in the skilled migration list, and they see it as a way to become an Australian resident” (initial interview).

Due to the high proportion of Asian students Mario seems to perceive that students expect the subject to be more teacher-centred. The way these beliefs influence Mario’s teaching practice is that he puts efforts into becoming more authoritative, which may be counterproductive to his desire to increase engagement,
“...Made myself a bit less approachable, a bit more authoritative and bit more the respected teacher, I think that’s also the nature of the cohort to establish that respect from the Chinese students” (initial interview).

**During the PD program**

Mario indicated that he is invested in shaping how students perceive him. This may be the reason that the sub-components to impart information and knowledge of subject are higher than his beliefs (Table 7-18). His learning facilitation beliefs and intentions are high, with a small increase in intentions for pastoral interest and interactive teaching manifested in increased attempts to trigger critical discussion. This is important because Mario is a caring and highly engaged teacher, which may be a key driver for his desire to train students for jobs and use media (Table 7-18).

Table 7.18 Case 9: Self-reports of change in sub-components of the teacher beliefs and intentions questionnaire.

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<td>Interactive teaching</td>
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<td>Facilitative teaching</td>
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<td>Pastoral interest</td>
<td>7</td>
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<td>Motivator of students</td>
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<td>Knowledge Transmission</td>
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<td>Training for specific jobs</td>
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<td>6</td>
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<td>10</td>
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<tr>
<td>Use of media</td>
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<td>8</td>
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<tr>
<td>Imparting information</td>
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<td>7</td>
<td>9</td>
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<tr>
<td>Knowledge of subject</td>
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To further understand the nature of Mario’s in-class interactions, he was asked to describe his students,

“A bit average, quieter, shyer. I think that actually comes from the non-English speaking background. Generally, I do find them quite intelligent, but they come from an education that is more memory based. So, it is trying to stress the fact that they are now post-grad students, so they need to stretch that. And I don’t think that is the students’ fault. That is actually the fault of the system that they came up through. But in saying that there are people who are quite good students here, people who put their hands up, people who are really active” (mid-program interview).
His epistemological beliefs seem to be quite flexible with constructivist tendencies, in line with Mario’s student-centred beliefs and tendencies. This is further supported by Mario’s explanation on how he knows learning has taken place,

“I try to do that by self-reflection. And getting them to answer questions, trying to explain to me their thinking. That is the one reason I like the small classes, so I can do that one on one. The good thing about Poll Everywhere is that it actually gives me the big picture on the main concepts. But the thing is that I want to see the difference between knowing the answer and actual understanding. And I want to see understanding” (mid-way program interview).

**After the PD Program**

To kick start the reflection on the influence of the PD program on Mario’s beliefs, he was asked to describe the difference between student vs. teacher-centred,

“So student-centred means you’re trying to give students the incentive to learn in a more self-directed way. And teacher-centred is more about the focus on how the teacher delivers the content” (mid-way program interview).

There is more clarity in Mario’s explanation, as well as a shift in awareness about the teacher’s role in the teaching-learning process. Mario was then asked to reflect on the results from the final assessment instrument (*Figure 7-56*). Note that his student-centred beliefs and intentions increased slightly but there was also a small increase in his teacher-centred beliefs and intentions,

"In some ways, it probably hasn't changed too much, because I do try to be student-centred. I just find it challenging to be student-centred. The lecture part is probably more teacher-centred, definitely. But that is probably right in the median. I do try to encourage cooperation in smaller groups and I do actually adopt some of the practice I've been observing” (final interview).
7.9.4 What I know: competencies

Before the PD Program

Mario’s extensive exposure to technological gadgets, both for gaming and educational purposes made his technology related TPACK components to be quite high (Figure 7-57). “Technology is something I’ve grown up with. It doesn’t worry me. It doesn’t scare me” (initial interview). This is evident in Mario’s use of a diversity of technological tools in the classroom. “I definitely use technology a lot more in my teaching than I did in my studies” (initial interview). In fact, Mario used a game-based simulation called SAP, he used an iPad to direct his lectures, the Lucidchart App to visually represent his workflows and had an advanced knowledge of the LMS. He also communicated, “I’m going to change to Poll Everywhere this year” (initial interview). Mario’s use of technology is only partially represented in his intermediate self-efficacy on knowledge to use cognitive tools (Figure 7-58). However, he affirms, “I’m probably the most technological person in the department” (initial interview).

Figure 7-57 Case 9: Self-reported changes to TPACK competencies, as measured by the TPACK assessment instrument by Schmidt et. al. (2009)
But Mario explained his lower confidence relating to Pedagogical Knowledge as, “I am self-taught” (initial interview). When it comes to Pedagogical Knowledge, he reports an intermediate self-efficacy of active learning methods (Figure 7-58). This correlates with the results from the initial assessment instrument where Pedagogical Knowledge was reported as a bit higher than the rest of the participants in this study sample (Figure 7-57). However, he still perceives his cohort is responsible for his approach to teaching,

“I’m teaching a group that is 95-90% Chinese based. To that extent, my teaching reflects my cohort, not necessarily what I would like to do. It’s how far can I actually take the cohort” (initial interview).

![Figure 7-58 Case 9: changes in self-efficacy in regards to pedagogical knowledge over the course of a semester](image)

**During the PD program**

The way Mario describes his students may partly be due to lack of confidence or knowledge about how to overcome the language challenges presented by his large cohort. The pedagogical support he received through the PD program focused on increasing engagement through case-based learning, peer instruction, cooperation strategies, and the flipped classroom.
During a design consultation, Mario forcefully rejected the idea of the flipped classroom claiming he knew about the term but didn’t like it. When questioned about his reasoning, he couldn’t explain beyond expressing a dislike. Nevertheless, the second section of the subject, the interactive tutorial sessions, requested students to do a reading and exercises to prepare for the tutorial; assessed student’s preparation at the beginning of the session using PollEverywhere; used the entire tutorial for small group activities, and would include follow up exercises. This meant that in practice and despite his dislike for the approach, half of Mario’s subject employed the flipped model of teaching. This seems to exemplify an underlying attitude observed in this case study. Mario is an advanced participant, but his pedagogical beliefs are fuelled by an overconfidence in his sometimes-superficial Pedagogical Knowledge. This created a resistance to new possibilities. At the same time, challenging Mario’s beliefs with evidence from the literature encountered a defensiveness that was counterproductive to the PD process. So instead, the PD approach shifted towards helping Mario become self-aware through observing his in-class performance. This process will be described in detail in the next section.

Technological support focused on the use of PollEverywhere as a cognitive tool to increase engagement from students with language difficulties. Mario was also advised to use the flowcharts on the Lucidchart App to get students to identify errors and misconceptions. Moreover, even though Mario had an advanced knowledge of the LMS, he was not aware of strategies to improve the content presentation. His online content needed to be more intuitively organized and had overwhelming amounts of information. So, he was supported through the PD program to completely restructure his online materials to make his subject more user-friendly.

Mid-way through the program Mario reported that the questions he was receiving from students were quite different from previous semesters. He explained that the only guidance they were seeking was a reaffirmation of their performance. There was less confusion about assignments, materials, and lectures. He was also reporting successful experiences with the use of PollEverywhere.
Students confirmed the benefits of these changes in their learning experience,

“It's easy to find the class materials and especially the assignment details and he has also put another category called SAP. It was good” (Student 2, focus group).

The students also appreciated the use of Poll Everywhere,

“I actually liked that because it was a big recap of what we learned. There was a pre-meeting before the seminars and lectures so we could remember what we have learned before” (Student 1, focus group).

“I think for the student who did not prepare before the tutorial, like me, it will help me determine what I know and what he is teaching” (Student 4, focus group).

**After the PD program**

There wasn’t much change in Mario’s technology-related TPACK components as a result of the PD program (*Figure 7-57*). But there was a moderate increase in Pedagogical Knowledge and a large increase in Pedagogical Content Knowledge (*Figure 7-57*). When asked to reflect on these changes, Mario explained,

"...that was the difference in delivery style. In some ways, in a smaller classroom I don’t necessarily want to use technology. I want the students interacting with each other rather than with technology” (final interview).

These reports are further corroborated by an analysis based on the Technology Integration Matrix (*Figure 7-59*). The findings indicate no changes in the quality of technology integration.
Perhaps the most positive influence is Mario’s renewed confidence in his ability to respond to the demands of his role,

“I think it helps me do my role better by making me more self-aware, from that point of view. And I do have a role mentoring staff, so I think I’m in a better place to do that. My pedagogical knowledge has improved. I have taken a new leadership role in teacher development within the faculty. So, in some ways, I feel more capable of taking that role” (final interview).

There is also a clear influence of the PD program in Mario’s self-efficacy in terms of knowledge to design for learning, assess active learning, enhance communication with students, increase cognitive engagement and use cognitive tools (Figure 7-58).
7.9.5 What I do: teaching practice

Before the PD Program

From the beginning, Mario expressed that he was quite happy with his subject’s design, but he expressed no desire to change the fact the subject was structured into two sections. His instructional strategies were also very strong, as Mario had extensive support from the learning specialists in his faculty. The grading rubrics in his subject are very detailed, he provides extensive support to his students, and has well-structured peer feedback strategies. The only materials that needed attention were the subject outline, as it was full of unnecessary information; the assessment guidelines, which had insufficient, unclear instructions, and there were opportunities to make the assessments more case-based.

![Figure 7-60 Case 9 Changes in the quality of technology integration based on the Technology Integration Matrix](image)

Initially, Mario reported high self-efficacy in regards to teaching competencies (Figure 7-60). However, he wasn’t as confident in his understanding active learning, implementing tasks and evaluating designs.
During the PD Program

The first update to the instructional materials regarded the subject outline. In this case, the subject outline is directly embedded into the LMS, and is not a printable document. This resulted in a complete restructuring of the subject’s materials in the platform. Clear guidelines to contact staff for support were included, a subject map was developed to coach students to prepare for each lesson, and materials were organized into weeks. A section for the SAP game and other significant supportive materials were also created.

The instructions to AT1, the peer feedback assignment, (Table 7-17) were rewritten to outline step by step actions. Moreover, two out of the four questions included in the assignment were rewritten to incorporate real-life scenarios, as previously the questions were mostly conceptual and not as engaging. AT2 was not updated as the initial learning design was already structured around a very authentic case.

As an advanced learner, Mario had a grasp of pedagogical strategies but was often not able to identify his own shortcomings during their implementation. Reflecting on the video recording of his class observation proved to be a powerful strategy. The first observation took place during the lecture section of the course. Mario observed that his students were actually participative and engaged, even if it was a large room. The lecture was based on a demonstration, and in fact, it was one of the most active in this case study sample. This enhanced the quality of technology integration as observed in the lectures (Figure 7-61).

However, it was evident that Mario was overly energetic. He rarely allowed students the space to reflect, or the time to process their experiences. Moreover, Mario was able to see that the reason his students were having difficulties engaging may have been due to language difficulties, but mainly it was due to the fact that
Mario talked too fast. In fact, so fast, that transcriptions of his speech during the observations were impossible given that some of the audio was unintelligible. This was a very profound and important realization for Mario, who was made aware that he needed to slow down and take a step back to allow students space and time to process information. Mid-way through the semester, Mario was reporting the benefits of this change,

“After reflecting on when you came into the class last week. I made a conscious effort to give students more time. Which I think it went really well, it engaged them more, so I think that is really good. I got more feedback from students, more participation. So, from that point of view, it worked well” (mid-way program interview).

The second class observation took place during the interactive tutorial sessions. Mario had the opportunity to observe that starting the tutorial with a formative assessment on PollEverywhere was a highly effective strategy. During the last part of the tutorial, students had the opportunity to work in small groups on an exercise. Mario walked around the classroom providing more personalized feedback and support. However, Mario lectured through nearly 1.5
hours of the 2.5 hours tutorial. This affected the quality of technology integration as observed in the tutorial session because even if technology was actually referred to, it was not used (Figure 7-61). Mario was made aware that students could get a lot more from the experience if they were able to log in into their SAP simulation and figure things out on their own, while he could provide more one-on-one guidance or feedback.

Later, Mario was also presented with the feedback from the focus groups which indicated that students needed more background to understand the connection of the game simulation to the real world,

“I feel that game was helpful just for engaging, I don’t know why we have this game. This game can help us to understand how the ERP, the whole process, how we can operate it, but is there any relationship to our examination?” (Student 2, focus group).

“At the end of the game, he did not give us a summary or give us general ideas about this game. It was just the end of the game and everyone [went] home. We were confused about what he really wanted us to know from this simulation and why he is testing us didn’t make sense” (student 4, focus group).

After the PD program

When Mario was asked to reflect on the influence of the PD program on his teaching practice, he said,

“Learning in terms of clarification, the fine-tuning. I’m 78% of the way there and this is just what you need to think about to take it the next step further. (Also) I’m probably a bit more aware now than previously, that’s given me a chance to reflect and reflect more on where I have different ways of doing things. Probably the reaffirmation that our role always lies here on the right track [...] helping me refine that. So probably knowing what requirements to make has helped me to increase my confidence” (final interview).

Mario also pointed out that the PD strategy most instrumental to self-awareness and self-efficacy was the reflection of the in-class observation,
“Probably learning a bit more about myself, having someone come in and do more of that peer review of me [...] It’s just getting feedback on what I’m actually doing, it’s not so much what I plan to. What you plan and want to do compared to what you do can be two quite different things. Even if I’m planning the right way, I might be delivering mostly the wrong way. I might not necessarily be seeing if it’s working semi-okay. I might not be realizing what I can then do to take it the next step further. So that peer review on what you’re doing in school. Maybe it’s a small change, but it’s just pushing the emphasis a bit more. It’s like, ‘Hey, great, but let’s make it fantastic’” (final interview).

This influenced Mario’s self-efficacy in terms of his abilities to understand, design and implement active learning tasks (Figure 7-60). Mario was also eager to share what he had learned in the PD program with his peers.

Some of Mario’s future plans for the subject included continuing to slow down his delivery and provide students the space to process, provide more debriefing after the game, include more think-pair-share activities, poll students at the beginning but also the end of the tutorial, use more polls during the lecture, and allow students to manipulate flowcharts on Lucidchart.

7.9.6 Case 9 discussion

Even with Mario’s initial high student-centred beliefs and intentions, it was still possible to see a transition in his teaching practice through Kember’s (1997) conceptions of teaching continuum. Mario started the PD program in the teacher-student interaction stage. He was the presenter and tutor of an interactive process to a cohort of students who were somewhat perceived as passive participants. The content was defined by Mario and discovered by students within his own framework. By the end of the PD program, Mario seemed to have transitioned into the facilitating understanding stage. He perceived himself as the facilitator responsible for helping students learn. And he was slowly becoming more comfortable in allowing students the space to construct and reflect on their own knowledge.
Mario’s self-awareness through reflections of actual in-class performance, resulted in enhanced Pedagogical Knowledge, increased self-efficacy, and a more interactive approach to teaching which seemed to facilitate more engagement by students. A focus on TPACK and learning designs also resulted in the successful integration of PollEverywhere into the tutorial sessions.

This case exemplifies how beliefs may be more influential to teaching practice than Pedagogical Knowledge. Mario had a strong negative reaction to the term flipped classroom, nevertheless, he was implementing the approach in the interactive tutorials because he believed his strategies were better suited to engaging his students.

This case also highlights that an effective PD approach to influence more advanced teachers is to create self-awareness. By guiding a person’s reflection on their own performance, it helps them to identify the exact nature of the issues they are experiencing, resulting in the humility needed for learning to occur. Consequently, the reflection of the class observations proved to be one of the most powerful strategies used in this PD program. Note that Mario’s perception of his students changed through becoming aware of the impact that his overly energetic approach was having on student participation. And this self-awareness enabled a more interactive approach and facilitated more student engagement.
8 Cross-Case Analysis

The objective of the previous chapter was to present the findings of a comprehensive mixed methods analysis of all data collected in order to build a narrative of each case study. That initial analysis focused on determining the influence of the PD program on individual participants' teaching practice. In this chapter, the objective is to present the findings from an analysis conducted across all nine case studies, from which particular patterns became apparent. The chapter has five sections. The first three sections will present evidence to demonstrate the influence of the PD program on teacher beliefs, TPACK and teaching practice. The fourth section will present evidence specific to motivation, value beliefs, self-efficacy, epistemological beliefs and contextual influences. The last section will present evidence of the effectiveness of the strategies in the PD program.

8.1 Pedagogical beliefs

Evidence of change in the pedagogical beliefs of participants was collected using a pre-post assessment instrument and a pre-post analysis of learning designs. Data collected through interviews and in-class observations were also used to corroborate findings.

The cross-case analysis revealed a distinct pattern of influence of the PD program on participants' pedagogical beliefs towards more student-centred orientations. A comparison of the pre-post assessment instrument responses across case studies (Figure 8-1) indicates, in shades of blue, that participants reported the greatest increase in percentage difference for intentions for learning facilitation (case 2,3,5,6,7,8) followed by an increase for beliefs for knowledge transmission (cases 1, 3, 4, 6, 8). Intentions for knowledge transmission also showed a slight increase (cases 1,2,3,9) while reports for beliefs for learning facilitation differed depending on each case.
The work of Norton et al. (2005) was used to interpret these results based on broad definitions of the constructs and the nature of the questions included in the survey. An increase in intentions for learning facilitation over beliefs suggests that as a result of the PD program, participants became more focused on implementing interactive and facilitative teaching, on using problem-solving as a broad pedagogical method, and were more invested in demonstrating intentions to motivate and/or care for the wellbeing of their students. At the same time, an increase in beliefs for knowledge transmission over intentions means that as a result of the PD program, participants decreased their focus on feeling responsible for training students for their future careers, for using media tools to aid in content delivery, and on imparting information in order to strengthen the knowledge of the subject.

![Figure 8-1 The change in participants' pedagogical beliefs indicated by the percentage difference in responses between the pre-post assessment instrument. Shades of blue indicate an increase and shades of red a decrease.](image)

T-tests showed that participants’ pre-values for both intentions and beliefs for learning facilitation and knowledge transmission were different from the post-values (Table 8-1). The findings from the t-test indicate a positive change in intentions over beliefs for learning facilitation orientations. However, in regards to knowledge transmission orientations, little to no significant changes were found.
A shift in participants’ teaching orientations towards learning facilitation intentions was also reflected in an analysis based on Kember’s (1997) teaching conceptions continuum (*Figure 8-2*). A noticeable pattern is that most participants started the PD program in the transmitting structured knowledge category (cases 1, 2, 3, 4, 5) or the imparting information category (cases 6, 7, 8). This suggests that initially, participants in the imparting information category focused on the “defined communication of structured bodies of knowledge” (Kember, 1997, p. 264). Participants in the transmitting structured knowledge category initially recognized the importance of delivering well-arranged and structured knowledge to give students a better chance of receiving it.

![Figure 8-2 Changes in participant's teaching practice across the teaching conceptions continuum](image-url)
This evidence also suggests that by the end of the PD program, participant's pedagogical beliefs, as evidenced by their enacted teaching behaviours, shifted towards more student-centred orientations; specifically, towards the student/teacher interaction apprenticeship category and the facilitating understanding category (Figure 8-2). Using the work of Kember (1999) outlined in Table 4-1 in chapter 4, this shift suggests that teachers in the student-teacher interaction apprenticeship category were guided to recognize the importance of peer-peer and student-teacher interactions as means for students to discover and understand core content (cases 1, 2, 3, 6); consequently, these participants were more willing to design tasks conducive to interaction, collaboration and critical discussion. The facilitating understanding category is characteristic of teachers that accept responsibility for guiding students to achieve the expected outcomes in the learning process. As a result of the PD program, participants in this category were more likely to engage students in assessment tasks that require active application of knowledge (cases 4, 5, 9).

These findings suggest that the reflective approach taken in the PD program - using interviews, reflections on video recording performance, assessment results and evaluation of their subject - had an effective, positive influence on eight out of nine participant's pedagogical beliefs and intentions towards learning facilitation orientations in a period of six to twelve months. These results are remarkable considering the work of Rienties et al. (2013) who implemented a PD program designed to influence pedagogical beliefs. Using the same assessment instrument as the current study, they identified no change in pedagogical beliefs. In addition, Tondeur et al. (2017) reported the effectiveness of a PD program with similar objectives, but they only observed changes in participants’ pedagogical beliefs after three years.

Participants in the current study also reported on the benefits of reflecting on their own beliefs. Qualitative evidence suggests that awareness not only equipped
participants to better respond to the teaching and administrative requirements of their role (cases 1, 2, 5, 6, 8, 9) but also changed their attitudes towards using technology in their teaching (cases 2, 3, 4, 6). In fact, in seven cases (except for cases 7, 8) enhanced awareness of beliefs seemed to precede changes in teaching practice, especially in terms of technology use. Moreover, in cases 3, 6, 8 participants’ awareness of their beliefs appeared to enhance their confidence in their own teaching abilities.

Data from the interviews support the argument that pedagogical beliefs, do partly, result from individuals’ past student experiences (cases 1, 2, 3, 5, 7, 8) or professional learning (cases 1, 4, 6, 9) (Ertmer, 2005; Kagan, 1992; Pajares, 1992). Moreover, the evidence indicates that pedagogical beliefs may sometimes exert a greater influence over teaching practice than Pedagogical Knowledge. For instance, consider that the learning designs from case studies 1, 2, 4, and 5 were based on varied pedagogical approaches prior to the PD program. However, participants’ self-reports indicated that they had little confidence or exposure to the pedagogical knowledge that could have informed the pedagogical approaches reflected in their learning designs (case 1, 2, 4, 5). Rather, participants articulated that they were often trying to replicate or avoid their own student or professional learning experiences.

### 8.2 Technological Pedagogical Content Knowledge (TPACK)

Evidence of changes in participants’ TPACK was collected through a pre-post assessment instrument and document analysis. This data was corroborated with interviews, in-class observations and focus groups with students.

A comparison of the pre-post assessment instrument responses across case studies (Figure 8-3) indicates, in shades of blue, that the greatest positive increase in percentage difference was related to Technological Content Knowledge (TCK) (cases 1, 3, 4, 5, 7, 8), followed by Pedagogical Content Knowledge (PCK) (cases 5, 6, 7, 8, 9) and TPACK (cases 3, 4, 5, 8). After completing the PD program, participants
reported a better understanding of how to integrate technology in their subject matter, as well as how to use instructional methods to teach their discipline. Positive changes in participants’ TPACK also suggest a better understanding of fit in their subject matter, their broad pedagogical approaches and the technological tools they use to engage students in learning. However, the findings also indicate a decrease in Technological Knowledge (TK) (cases 1, 3, 4, 5, 6, 7, 8, 9,) and Pedagogical Knowledge (PK) (cases 3, 4, 5, 6, 7, 8, 9). This suggests that participants’ knowledge of how to use technological tools and methods of teaching lessened after the PD program. Note how these two patterns seem in direct contradiction to each other.

These findings seem to suggest that Schmidt et al. (2009) diagnostic survey is neither granular nor reliable enough to represent the complexity of actual teaching practices. Therefore, to understand this contradiction more deeply, a paired t-test was performed to measure the mean (p-value) of the pre-post assessment instrument results (Table 8-2). This analysis largely corroborated the above findings, except that Technological Pedagogical Knowledge (TPK) instead of (TCK) was identified as the component with the greatest change. This suggests that participants reported an increased understanding of how to use technology to teach, yet felt less knowledgeable about how to use technology and instructional methods.
Table 8.2 Results from a t-test calculated based on the pre-post diagnostic across case studies, which reports on the influence of the PD program on participants’ TPACK. Note that <0.001 indicates a positive, significant change.

<table>
<thead>
<tr>
<th>Knowledge Component</th>
<th>Pre-test</th>
<th>Post-test</th>
<th>Statistical value</th>
<th>p_value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technological Pedagogical Knowledge (TPK)</td>
<td>72.44</td>
<td>86.66</td>
<td>3.82</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Technological Content Knowledge (TCK)</td>
<td>64.44</td>
<td>80</td>
<td>3.5</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>TPACK</td>
<td>66.66</td>
<td>81.33</td>
<td>2.96</td>
<td>0.017</td>
</tr>
<tr>
<td>Pedagogical Content Knowledge (PCK)</td>
<td>73.33</td>
<td>88.88</td>
<td>2.8</td>
<td>0.023</td>
</tr>
<tr>
<td>Pedagogical Knowledge (PK)</td>
<td>74.92</td>
<td>84.12</td>
<td>2.14</td>
<td>0.063</td>
</tr>
<tr>
<td>Technological Knowledge (TK)</td>
<td>59.21</td>
<td>65.07</td>
<td>1.6</td>
<td>0.14</td>
</tr>
</tbody>
</table>

These findings were then triangulated with the interview data, which revealed that case studies 2, 4, 5, 6, and 8 had all admitted to rating themselves higher in the initial diagnostic due to their insufficient knowledge. By the final interview, their enhanced knowledge enabled them to state that their initial scores were overestimated. This suggests that the contradictory patterns that emerged from the assessment instrument may have been due to the Dunning Kruger effect, a cognitive phenomenon in which “poor performers in many social and intellectual domains seem largely unaware of just how deficient their expertise is” (Dunning, 2011, p. 247).

What is more, the patterns that emerged from the analysis of the interviews, confidence logs, in-class observations, and document analysis, did not completely reflect the findings from the assessment instrument. For example, Pedagogical Knowledge (PK, Table 8-2) was one of the components that was found to have had no significant change. However, in interviews, most participants reported an increase in PK and attributed that increase to the focus of the PD program on their own curriculum designs. More specifically, the focus groups, in-class observation, and subject evaluation confirmed there were tendencies for interactive and facilitative teaching (case 2, 3, 4, 5, 6, 8) pointing to an increase in PK. These participants also reported that their PK helped them guide the implementation of learning tasks, aided in class management, as well as provided the means for students and teachers to represent ideas and content. Throughout the PD program,
participants articulated that PK was a useful component to create a safe learning environment, to facilitate the transfer of skills such as negotiation and collaboration, to stimulate students to become independent learners and to guide formative evaluation efforts.

Furthermore, Technological Pedagogical Knowledge (TPK) was found to have little change via the assessment instrument, yet in interviews it was the second most common TPACK component. These reports were related to the benefits and/or limitations of technological tools on the teaching-learning process. The most common challenges in this context included lack of confidence in troubleshooting abilities, too much content to deliver, lack of time to review and restructure materials, and difficulties with online engagement.

On the other hand, changes in Pedagogical Content Knowledge (PCK) showed alignment across the assessment instrument, t-test and interviews. For instance, data from the interviews suggested that high PCK resulted from an extensive professional career. Data from the confidence logs and document analysis suggested that higher PCK was also associated with higher self-efficacy. This confidence appeared to relate not only to participants’ understanding of the nature of their discipline, and how their discipline-specific knowledge should be taught, but also helped them identify which skills needed to be developed for their students to become successful professionals (cases 1, 2, 4, 6, 9).

8.3 Teaching practice

Evidence of change in actual teaching performance of participants was collected through pre-post analysis of learning designs, in-class observations, as well as a summative evaluation of the subjects that participants taught. The summative evaluation considered feedback from student focus groups and LMS statistics.
Over the course of the PD program, there was an increased tendency for some participants to use active pedagogical approaches in their practice (*Table 8-3*). These changes mainly manifested in the increased use of case-based learning, the flipped classroom, collaboration, and project-based learning. Other methods such as game-based learning were also reflected to a lesser degree in some learning designs. Evidence of small (cases 2, 5, 9 in yellow), moderate (cases 3 and 4 in light green) and large changes (case 6 in green) were observed in participants’ pedagogical behaviours. These changes suggest a willingness to involve students in cognitive and social engagement through critical discussion, collaboration, problem solving and enhanced connections of content to industry practices (Chi and Wylie, 2014). However, in three cases there were no evident changes (cases 1, 7, 8 in red). In cases 7 and 8, contextual influences were uncovered which may have prevented changes in practice to occur (see chapter 7). Case 1 was the pilot study which revealed that further support was required and the PD program was subsequently refined.
Table 8.3 Comparison of pedagogical approach based on observation, self-reports and learning designs before and after the PD for each of the nine case studies

<table>
<thead>
<tr>
<th>Case 1: Leon</th>
<th>Before</th>
<th>After</th>
<th>Legend</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Story room approach, teacher was performer</td>
<td>Story room approach, teacher was performer</td>
<td>No change</td>
</tr>
<tr>
<td>Case 2: Hillary</td>
<td>Sporadic attempts for critical discussion. Teacher feels overwhelmed and focuses on knowledge transmission to try to 'control' evaluation of performance from students.</td>
<td>Confidence to let go of control. More invited guest lecturers, tendency for critical discussion and demonstrations</td>
<td>Small Change = minor improvements to original approach with sporadic opportunities for some critical discussion</td>
</tr>
<tr>
<td>Case 3: Delia</td>
<td>Unstructured discussion, and insufficient lesson planning, forces the teacher to focus on knowledge transmission in a frantic attempt to finish core content.</td>
<td>Improved lesson structure. Increased tendencies for case based discussion and collaboration.</td>
<td>Moderate change = considerable improvements to original approach resulting in increased quality of engagement through critical discussion</td>
</tr>
<tr>
<td>Case 4: Sandra</td>
<td>Class started with a test, included some activities and discussion. But most of the lesson was focused on teacher as most active participant. Focus on knowledge transmission.</td>
<td>Evidence-based implementation of the flipped classroom. Increased tendency for more critical discussion and problem solving in small groups.</td>
<td>Large change = Considerable transformation of original setup, and adoption of active learning activities that not only lead to critical discussion, but are conducive to collaboration, planning or problem solving in class.</td>
</tr>
<tr>
<td>Case 5: Janis</td>
<td>Mostly based on group discussion but teacher was experiencing classroom management issues that were affecting her self-confidence.</td>
<td>Increased self confidence had profound influences on teacher-student interaction. Increased tendencies for collaborative work and critical discussion.</td>
<td></td>
</tr>
<tr>
<td>Case 6: Tina</td>
<td>Unstructured focus on passive knowledge transmission. Minimal engagement with students in a fully online learning environment.</td>
<td>Enhanced learning designs and content presentation in online platform. Increased case based, collaborative discussion through webinars.</td>
<td></td>
</tr>
<tr>
<td>Case 7: Karla</td>
<td>Structured focus on passive knowledge transmission in an fully online learning environment. Minimal engagement.</td>
<td>no change</td>
<td></td>
</tr>
<tr>
<td>Case 8: Julia</td>
<td>Often due to lack of confidence with content, teacher focuses on pure knowledge transmission.</td>
<td>displayed case based approach but reverted back to structured lecturing.</td>
<td></td>
</tr>
<tr>
<td>Case 9: Mario</td>
<td>Game based, case based, active learning.</td>
<td>Most of approach is same except for enhanced interactive opportunities for participation, class discussion and in class reflection.</td>
<td></td>
</tr>
</tbody>
</table>
The results suggest that a focus on learning design (LD) was a moderately effective way to enhance pedagogical approaches (cases 3, 4, 6). By using visual representations of learning tasks, PD discussions could be infused with evidence-based suggestions on how to redesign, implement, and evaluate tasks. Discussions on constructive alignment also enabled participants’ to critically analyse the selection of technological tools in a manner that was supportive of their broad pedagogical approaches.

In regards to the influence of the PD program on actual uses of educational technology, the patterns that emerged from the cross-case analysis vary according to what is understood as effective or improved technology integration. If technology integration is understood to mean an increase in the number of technological tools used, or more sophisticated uses of those tools, then this PD program had a visible impact. Seven out of nine cases reflected improvements ranging from small but sophisticated uses of technological tools to large changes evident in the adoption of at least two new tools (Table 8-4). However, some authors do not recommend technology-driven teaching approaches, unless the discipline requires it, as they can divert students’ attention away from achieving learning outcomes (Beetham, 2013; Beetham and Sharpe, 2013; Lawless and Pellegrino, 2007). Moreover, ‘technocentric’ PD efforts have been argued to be ineffective given that they are disconnected from actual teaching practice (Baran et al., 2016). Given that TPACK as the conceptual framework for the current study encourages the intersection of knowledge components, also known as fit, a technologically driven conceptualization of technology integration is not considered adequate (Harris et al., 2010; Mishra and Koehler, 2006).
If technology integration is understood to mean the pedagogically sound use of technology, then this PD program also had a visible influence. For example, over the course of the PD program, more sophisticated uses of the institutional LMS were evident in the form of peer feedback strategies, increased teacher-student and peer-to-peer communication, automation of the grading process, improved guidance on content presentation, engagement through blogs, and access to recorded lectures (cases 1, 3, 5, 6 and 9). Moreover, increase of the use of ZOOM (online conferencing) for webinars was also evident to engage off-campus students (Cases 2, 6, and 7). Polleverywhere was also used as a powerful tool to engage students with language difficulties through the use of polls (cases 4 and 9). Although these changes exemplify increases in Technological Pedagogical Knowledge (TPK), they still do not reflect *fit*.

In the current study, the quality of technology integration was viewed through the lens of TPACK as the seamless integration of technology in a manner that best supports broad pedagogical approaches to teach a particular subject (Koehler and Mishra, 2009). Evidence of quality of technology integration in relation to *fit* was collected through the Technology Integration Assessment Instrument (TIAI) (Harris et al., 2010) and the Technology Integration Matrix (TIM) (Welsh, Harmes, and Winkelman, 2011). Given that the TIAI could not be used across all case study samples due to contextual limitations, it was used as a complementary method during the evaluation of

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**Table 8.4 Summary of changes to participants’ uses of technology as a result of the PD program**

<table>
<thead>
<tr>
<th># of cases</th>
<th>Level of adoption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sandra (4), Tina (6),</td>
<td>Large improvement to original setup and adopted one or two</td>
</tr>
<tr>
<td>Mario (9)</td>
<td>tools</td>
</tr>
<tr>
<td>Hillary (2) and Delia (3)</td>
<td>Moderate improvement to setup or adopted one tool</td>
</tr>
<tr>
<td>Leon (1) and Janis (5)</td>
<td>Improved original setup</td>
</tr>
<tr>
<td>Karla (7) and Julia (8)</td>
<td>No change</td>
</tr>
</tbody>
</table>

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330
participants’ subjects, as well as a method to corroborate findings. Evidence of change using the TIAI were seen in six out of the nine case studies; as previously explained, cases 7 and 8 had external influences that prevented curricular changes and case 9 required improvements to the delivery of content, rather than to the learning designs.

The TIM, on the other hand, was partially based on analysing participant’s learning designs but enabled a more mixed approach in which the document analysis was corroborated with interviews, subject evaluation, and in-class observations. The patterns that were identified using the TIM have both pedagogical and developmental aspects (*Figure 8-4*). From a pedagogical perspective, the pattern suggests that participants used technology to support the implementation of authentic, constructive and collaborative assessment tasks. Welsh et al. (2011) proposes that authentic environments required teachers to use technology to engage students in activities that link the subject matter to the world beyond their instructional setting. In the current study, technology was used in this way in five cases (case 2, 3, 4, 5, 6). A constructive environment required participants to use technology to connect discipline-specific content to prior knowledge (cases 2, 6, 7, 8). Finally, collaborative environments required participants to use technology to engage students in collaborative group work (case 1, 6, 9).

From a developmental perspective, one of the patterns identified in *Figure 8-4* is that participants’ uses of technology prior to the PD program were at the entry (cases 1, 6, 3, 7) and adoption level (case 1, 2, 4, 5, 6, 7, 9). Entry level suggests that prior to the PD program, participants were using technology to support simple forms of knowledge transmission, such as using the institutional LMS as a repository of PDFs. The adoption level suggests that participants directed “conventional and procedural” uses of technological tools, such as using the journal or quiz function of the LMS (Welsh et al., 2011). By the end of the PD program, the tasks in participants’ curriculum reflected a shift into the adaption and the transformation levels. The adaption level suggests that
participants were directing students to more independent use of technology, such as the use of discussion boards within groups for peer feedback on recorded interviews before submitting a report, or enabling group journals for collaborative planning before a project (case 1, 3, 4, 6, 9). The transformation level suggests participants were using technological tools to facilitate higher order level activities that could not have been possible without the use of technology (cases 1, 6); for example, using ZOOM for discussion based webinars around health care plans with off-campus students, or the use of blogs as part of a formative assessment strategy that included peer feedback and culminated in an original script for a film. On the other hand, for four cases there was no change in the quality of technology integration (cases 2, 5, 7, 8). This suggests these participants continued to use the same technological tools in similar ways, despite the enhancements to the broad pedagogical approaches reflected in their learning designs.
Figure 8-4 Changes to the use of technology in each assessment task (AT) as measured by the Technology Integration Matrix
8.4 Intrinsic and external influences

Evidence of changes in participants’ motivation, value beliefs, self-efficacy beliefs and epistemological beliefs was collected using interviews, pre-post assessment instrument and confidence logs.

8.4.1 Motivation

To begin with, data on participants’ motivation was collected through an open question in the assessment instrument, and interview data. After an unsuccessful recruitment strategy during the first iteration, the PD program was refined so that instead of Heads of departments recommending teaching staff to participate, teaching staff could choose to participate themselves making the recruitment process more confidential (For more information refer to chapter 5). This enhancement attracted participants who reported self-directed motives for improving their teaching practice, which largely manifested as positive attitudes and predispositions towards the PD program. Still, the nature of those motives varied (Table 8-5).

The motive of efficiency and effectiveness was characteristic of participants who were time poor and needed to streamline the administration of their teaching practice (Table 8-5). This, however, seemed to have a negative effect on their willingness to invest the time needed to learn new technological tools or explore learning and design theory. The motive of increasing student engagement with the content was identified as having positive effects on participants’ willingness and open-mindedness to apply the suggestions of the PD program, except in cases when contextual influences prevented changes in practice to occur. Moreover, the motive to improve the results of student experience surveys or improve class management issues was identified through interviews to be based on low self-efficacy or fear that negative, past experiences may reoccur. This seemed to be a powerful motivator for participants to invest the time needed for improvements in their practice to take place.
Table 8.5 Participants’ motives to participate in the PD program

<table>
<thead>
<tr>
<th>Motives for participating in the PD program</th>
<th>Evidence in the case study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase student engagement with the content</td>
<td>2, 6, 7, 8, 9</td>
</tr>
<tr>
<td>Efficiency and effectiveness of teaching practice</td>
<td>1, 4</td>
</tr>
<tr>
<td>Improve student experience surveys</td>
<td>3</td>
</tr>
<tr>
<td>Class management issues</td>
<td>5</td>
</tr>
</tbody>
</table>

8.4.2 Value beliefs

Evidence of value beliefs was identified in the interviews and research journal. Value beliefs are considered to be “constructs of worth” (Aadland, 2010), and were identified to be filtering mechanisms based on personal preferences that helped participants determine if the suggestions for improvement presented through the PD program were worthy of implementation. As outlined by Galvão de Barba (2017), a perception of the usefulness or relevance of technological tools can influence peoples’ decision to invest the time and effort (the cost) required to enhance their technology integration practices. Consequently, participants’ value beliefs had a positive and negative influence on the outcomes of the PD program. For example, a preference for manual methods (case 5), a general mistrust of technology (case 8) or contextual constraints (case 7) seemed to convince participants of the utility value of technological tools, making them a low priority in their teaching practice. Because these participants did not perceive tools to be relevant, they invested little effort into enhancing their technology integration practices.

On the other hand, attainment value is the relevance a teacher assigns to good performance and how this performance can express aspects of self-identity (Galvão de Barba, 2017). Attainment value had a positive influence on teachers’ willingness to improve teaching practice through enhanced pedagogical actions (case 3, 5) or enhanced uses of technology (case 4). Moreover, the student focus groups and interviews provided insights into how evidence-based pedagogical
implementations had a positive effect on the quality of engagement and motivation of participants. This strategy seemed to confirm to participants that their curriculum was on the right track, thus increasing the importance of improving it (case 2, 6, 9).

8.4.3 Self-efficacy

Self-efficacy is an individual's confidence in their capacity to control their performance and their own lives (Bandura, 1993). Evidence of change in self-efficacy was based on self-reports collected through confidence logs at the start, during and at the end of the PD program. Two different types of confidence logs were collected. The first log measured participants' confidence in their knowledge of methods and strategies of teaching, while the second log focused on their confidence to enact their teaching competencies.

The results form a t-test provides evidence to suggest that participants perceived positive improvements to both their knowledge and competency-based self-efficacy as a result of their PD program (Table 8-6, 8-7). Note that in regards to competency-based self-efficacy (Table 8-6), the most positive changes relate to the use of cognitive tools, knowledge on how to assess active learning, how to design for learning and how to enhance communication with students. These changes are reflected in similar improvements in knowledge-based confidence (Table 8-7) such as selecting technological tools, implementing tasks, evaluating designs and reviewing objectives. All other teaching behaviours reflect a change but to a smaller degree. These results suggest that the more knowledge participants gained, the more equipped they felt to enact that knowledge.
Table 8.6 Changes in competency-based self-efficacy, as evidence by self-reports in the confidence logs. <0.001 indicates a significant change.

<table>
<thead>
<tr>
<th>Pedagogical Element</th>
<th>Initial confidence log (%)</th>
<th>Final confidence log (%)</th>
<th>Statistical value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teach with Active learning</td>
<td>46.66</td>
<td>80</td>
<td>3.16</td>
<td>0.013</td>
</tr>
<tr>
<td>Assessing active learning</td>
<td>31.11</td>
<td>77.77</td>
<td>6.26</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Using the Flipped Classroom Approach</td>
<td>46.66</td>
<td>82.22</td>
<td>4.09</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Designing for Learning</td>
<td>31.11</td>
<td>82.22</td>
<td>6.2</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Evaluating and improving your design</td>
<td>48.88</td>
<td>84.44</td>
<td>3.24</td>
<td>0.011</td>
</tr>
<tr>
<td>Increasing Cognitive Engagement</td>
<td>46.66</td>
<td>77.77</td>
<td>3.27</td>
<td>0.011</td>
</tr>
<tr>
<td>Learning strategies for students</td>
<td>55.55</td>
<td>73.33</td>
<td>1.73</td>
<td>0.12</td>
</tr>
<tr>
<td>Using Cognitive tools</td>
<td>24.44</td>
<td>60</td>
<td>6.4</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Enhancing communication with students</td>
<td>46.66</td>
<td>80</td>
<td>5</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Table 8.7 Changes in knowledge-based self-efficacy, as evidence by self-reports in the confidence logs. <0.001 indicates a significant change.

<table>
<thead>
<tr>
<th>Teaching behaviour</th>
<th>Initial confidence log (%)</th>
<th>Final confidence log (%)</th>
<th>Statistical value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Review objectives</td>
<td>80</td>
<td>97.77</td>
<td>3.41</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Apply constructive alignment</td>
<td>73.33</td>
<td>91.11</td>
<td>2.87</td>
<td>0.02</td>
</tr>
<tr>
<td>Brainstorm active learning</td>
<td>68.88</td>
<td>88.88</td>
<td>2.26</td>
<td>0.05</td>
</tr>
<tr>
<td>Understanding active learning</td>
<td>60</td>
<td>84.44</td>
<td>2.81</td>
<td>0.022</td>
</tr>
<tr>
<td>Design active learning</td>
<td>62.22</td>
<td>84.44</td>
<td>2.62</td>
<td>0.03</td>
</tr>
<tr>
<td>Select tech tools</td>
<td>53.33</td>
<td>75.55</td>
<td>4.26</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Use tech tools</td>
<td>55.55</td>
<td>71.11</td>
<td>2.13</td>
<td>0.065</td>
</tr>
<tr>
<td>Implement tasks</td>
<td>53.33</td>
<td>82.22</td>
<td>4.27</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Evaluate design</td>
<td>51.11</td>
<td>82.22</td>
<td>4.12</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

During the interviews, however, contradictory evidence was articulated by participants’ when they were asked to reflect on their self-efficacy reports. This reflection led one participant to say, “I’m not confident until I am competent” (case 4, final interview) while another participant stated, “I think the more you learn what you should be doing, the less confident you feel that you are doing it” (case 6, final interview).
8.4.4 Epistemological beliefs

Epistemological beliefs describe an individual’s views about the nature of knowledge and how it is acquired (Marlene Schommer-Aikins, Orpha K. Duell, and Rosetta Hutter, 2005). In the current study, evidence of epistemological beliefs was collected through self-reports during the mid-program interview. Participants were asked, “what is learning?” “How is knowledge acquired?” “And how do students learn best?” The data was analysed using Schommer’s (1990) five-factor structure (Figure 8-7) which allows participants’ beliefs to be categorized into structure of knowledge, stability of knowledge, source of knowledge, speed of knowledge, as well as beliefs on students’ ability to learn. In Schommer’s (1990) view, this categorisation then enables a determination of whether the personal epistemologies of teachers are sophisticated or naïve.

**Structure of Knowledge**

- **Isolated – case 8**
- **Integrated - Cases 1, 2, 3, 5, 6, 9**

**Stability of knowledge**

- **Certain – case 8**
- **Evolving – cases 1, 2, 3, 4, 5, 6, 7, 9**

**Source of knowledge**

- **Authority**
- **Reason/evidence – cases 1, 2, 3, 4, 5, 6, 7, 8, 9**

**Speed of learning**

- **Quick – cases 4, 8**
- **Gradual – cases 2, 5, 6, 7, 9**

**Ability to learn** – no mention

**Fixed**

- **Improvable**

*Figure 8-5 Cross case study analysis of participants' epistemological beliefs based on Schommer (1990) five-factor structure.*
The data suggests that participants, with the exception of case 8, believe that knowledge is made up of integrated concepts that derive from evidence or reason and is gradually evolving. Arredondo and Rucinski (1996a) label personal epistemologies with these characteristics as “sophisticated” and teachers holding these are less likely to implement traditional teaching strategies such as rote learning. This analysis suggests an association between participants’ personal epistemologies and the shift towards more student-centred approaches such as interactive and facilitative teaching.

This association is also supported by the work of Marlene Schommer-Aikins et al. (2005) who argue that personal epistemologies lead to internal standards, which in turn, inform the teacher’s broad pedagogical approaches and expectations of the learning-teaching process. For instance, in the current study sample, participants’ beliefs about the gradually evolving nature of integrated concepts, may have enabled a shift towards more active pedagogical approaches such as case-based or collaborative learning.

Although this study sample does not provide enough evidence to establish connections to domain-specific epistemologies, case 8 highlights a relationship between value beliefs, pedagogical content knowledge, and epistemological beliefs. In this case, the participant strongly believed that technology was not important to teach law, partially based on the belief that the foundation of law practice depended on cumulative knowledge of the judicial principles of isolated cases.

8.4.5 Contextual influences

This cross-case analysis also provided deeper insights into the perceived nature of contextual influence exerted by organizational culture on participants’ teaching practice. Evidence of contextual influences was collected through self-reports during interviews. Reports partly related to the negative influence of a lack of administrative support on teaching practice (case 2, 5, 7) and anxiety over annual
performance reviews given the emphasis on research outputs rather than teaching and learning outcomes (case 1, 8). Another pattern was identified amongst novice teachers, sessional staff members and teachers with no research responsibilities, who reported no influence of organizational culture on their teaching practice (3, 4, 6, 9). The only constraint these teachers reported was a lack of communication with colleagues within their faculty. This reported isolation influenced their willingness to support or collaborate with others, including a reluctance and lack of trust in Peer Review of Teaching practice.

8.5 Effective PD strategies

Evidence of the effectiveness of each strategy used in the PD program was determined through satisfaction reports and mixed methods analysis. During the final interview, participants were asked to reflect on the strategies they thought were most effective in helping them improve their technology integration practices (Figure 8-6). Participants reported that the one-on-one design consultations (all cases), the PD website (cases 2, 3, 4, 5, 6, 7, 8, 9), the reflection on the video recordings of their teaching performance (cases 3, 4, 5, 8, 9), and the subject evaluation (cases 1, 2, 5, 8, 9) were the most helpful. However, given that satisfaction reports can be subjective, each PD outcome identified in the individual case analysis was traced back to the specific strategy that influenced that outcome (Table 8-8). The evidence suggests that the one-on-one consultations, the video recorded reflections on performance, the subject evaluation and the discussion of the results from the assessment instrument during the initial and final interviews were found to be the most influential.

Overall, the cross case analysis provides evidence to suggest that the PD program was an effective approach to influence teachers’ beliefs, pedagogical approaches, technology uses, and self-efficacy.
Figure 8-6 Participants’ reports of the perceived effectiveness of PD program strategies during the final interview

Table 8.8 Summary of outcomes of PD program linked to the specific PD strategy that influenced it, and the case study number that provided the evidence

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Result</th>
<th>Case #</th>
</tr>
</thead>
<tbody>
<tr>
<td>One-on-one consultations</td>
<td>Improvements to the quality of learning designs</td>
<td>1,2,3,4,5,6,9</td>
</tr>
<tr>
<td></td>
<td>Increased Technological Pedagogical Knowledge (TPK)</td>
<td>1,2,3,4,5,6,9</td>
</tr>
<tr>
<td></td>
<td>Improved self-efficacy</td>
<td>2,5,6,7,8</td>
</tr>
<tr>
<td></td>
<td>Increased Pedagogical Knowledge (PK)</td>
<td>2,6,9</td>
</tr>
<tr>
<td>Reflection of a video recording of the in-class performance</td>
<td>Increase in facilitative and/or interactive teaching tendencies</td>
<td>2,3,4,8,9</td>
</tr>
<tr>
<td></td>
<td>Increased self-efficacy</td>
<td>1,5</td>
</tr>
<tr>
<td>Evaluation</td>
<td>Increased Pedagogical Knowledge</td>
<td>1,5,9</td>
</tr>
<tr>
<td></td>
<td>Confirmation of approach as a result of feedback from students (focus groups)</td>
<td>5,8</td>
</tr>
<tr>
<td></td>
<td>Enhanced learning designs</td>
<td>1</td>
</tr>
<tr>
<td>2q Interview/diagnostic of competencies</td>
<td>Awareness resulted in a change of attitude towards tech</td>
<td>2, 3, 4, 6</td>
</tr>
<tr>
<td></td>
<td>Awareness resulted in confidence to perform in a teaching role</td>
<td>1, 2, 5, 6, 8, 9</td>
</tr>
</tbody>
</table>
9 Discussion

Evidence has been presented that suggests that the PD program designed for the current study was effective in influencing teachers’ beliefs, supporting the quality of technology integration and enhancing the self-efficacy. It also had an impact on actual teaching practice, but to differing degrees depending on the case. The longitudinal implementation of the PD program allowed prolonged support to be provided to teachers to assist them to plan, implement and evaluate their subjects, while enabling ongoing conversations to strengthen self-awareness. The program transcended knowledge transmission models by combining evidence-based strategies with flexible, hands-on, collaborative practice that was responsive to participants’ needs and individual contexts. The PD program in its current form, however, is resource intensive given the one-on-one interaction between teacher and facilitator and the length of engagement with participants’ teaching practice. As such, questions arise regarding the sustainability and scalability of such a PD program across higher education institutions. This is especially the case considering the increasing trend of universities to employ sessional staff who may be given limited time and monetary resources (if at all) to support their PD. Nevertheless, parts of this PD program are arguably highly valuable, and in this chapter, principles to inform the design of reflective PD programs that consider the need for practicality, scalability, and generalizability, will be drawn from the study’s findings.

The following discussion is structured around the research questions that guided this doctoral program of research.

9.1 RQ1: What are the salient features that characterize an effective PD program in terms of influence on university teachers’ use of educational technologies?

The initial literature review that informed the design of the PD program identified six critical elements:

- Promote reflective practice
Focus on teaching practice
Consider delivery methods
A careful selection of technical infrastructure
Take into account organizational culture
Promote collaboration (for more information refer to chapter 2).

Each of these six elements will be discussed below in relation to evidence-based recommendations from the literature and findings from the current study. From this, a set of principle to inform the design of PD program for technology integration in higher education will be synthesized.

Promote reflective practice

The promotion of reflective practice was an essential feature of the PD program. Evidence-based recommendations from the literature point to enabling continuous assessments of teachers’ needs and practice (Ertmer et al., 2012), making explicit pedagogical beliefs (Ertmer, 2005) and providing ongoing feedback (Grainger et al., 2015). The evidence found in the current study supports the work of Turkich et al. (2014) who found that reflective practice is able to accelerate the development of teaching competencies due to enhanced awareness and self-efficacy. What is more, an oversight of this element can have detrimental effects on PD outcomes in the long term. This is due to the nature of pedagogical beliefs in relation to PD, for example, Ertmer and Ottenbreit-Leftwich (2010) found that pedagogical beliefs act as filters of pedagogical strategies prior to their assimilation into practice. As such, university teachers can have positive inclinations to improving their own practice; however, if a strategy presented in a PD program does not align with their beliefs, they are unlikely to implement it in practice. The current study provided evidence to support this argument, especially in relation to how pedagogical and value beliefs can inform teachers’ choice to use (or not) use technological tools.
As a result of the evaluation of the PD program through the nine cases studies, it was found that the most effective way to implement the element of reflective practice into the PD program was via the use of collaborative reflections of videotaped performances of teaching practice; reflective semi-structure interviews; and the formative and summative appraisal of participants’ subject(s).

The collaborative reflection of videotaped performance often resulted in confronting and humbling effects on participants, regardless of their teaching experience, beliefs or expertise. This seemed to be especially effective with defensive or overly confident individuals, perhaps because it was difficult to argue with evidence of one’s own performance. The review of videotaped performance often resulted in a renewed motivation of the teachers to enhance their practice, while enabling them to recognize the exact nature of their practice. This finding aligns with findings from a systematic review conducted by Kagan (1992) on the beliefs of K-12 teachers. The author reports on studies that used recordings of class observations and reflective interviews to explore the influence of beliefs on teaching performance and concluded that teaching practice is “congruent with teacher orientations of subject matter…and consistent with teacher beliefs” (p.71).

The reflection on videotaped performance also helped teachers to identify key areas for improvement, and most importantly, it kept them accountable to their own improvement plans. This was especially evident during the third iteration of the PD program, which involved two instead of one in-class observation. This finding is in agreement with the work of Smith and Neale (1989) who engaged ten elementary school teachers in a reflective process through stimulated recall using videos of class performance and interviews, and found that influences on teaching orientations were directly associated with changes in classroom practice.
Reflective semi-structured interviews were found to be a useful and practical way to raise awareness of the beliefs driving participants teaching practice, as well as to help them identify areas for improvement. This strategy was informed by the work of Kim et al., (2013) who used semi-structured interviews to explore the association between the teaching approach of 22 teachers and their technology integration practice. However, The PD program in the current study built on the work of Kim et al., (2013) by explicitly showing teachers the progress they had made over the course of the PD program, to further support self-regulation and reflection. For example, the results from the pre-post diagnostic survey and confidence logs were discussed with participants during interviews to focus reflection on perceptions of their own teaching practice.

The strategy of ongoing evaluation in which formative and summative evaluation interviews are used to establish a cyclical process of action and reflection by which to evaluate the impact of a PD program on teachers TPACK, has been used previously by Lehiste (2015). However, in the current study, the strategy not only involved evaluating the influence of the PD program on participants’ technology integration practice but also involved identifying opportunities for formative evaluation and summative evaluation of their subject(s). Within cases it was often observed that student evaluation surveys were the only evaluation instrument available to participants. Since these surveys are often designed as an instrument for performance management, they are limited in the type of information they provide for teachers to help them enhance their curriculum or pedagogical approaches. Teachers in the current study, were observed to lack the ability or the willingness, to actively seek out feedback from students on their teaching. Therefore, supporting teachers to develop the habit of ongoing evaluation, was found to have a significant influence on their teaching practice. In summary, the promotion of reflective practice is recommended as a design principle to guide the design of other PD programs in higher education (Table 9-1).
Technical infrastructure

The careful selection of technical infrastructure was found to be an essential element of PD to support technology integration practices. According to Valanides and Angel (2005), the objective here is to help reduce teacher anxiety over low technological skills and increase the willingness of university teachers to learn the functionality needed to adopt new technological tools. Evidence-based recommendations here include exploring the affordances and limitations of technological tools prior to the implementation of the PD program (Campbell et al., 2015; Wang et al., 2014), and using a website to deliver content (Conole and Jones, 2010). Findings from the current study, suggest both these approaches were critical for the effectiveness of the PD program. In fact, this finding supports the work of Conole and Jones (2010) who argue that “infrastructures for learning support the interconnectedness of artefacts” (p.3); thus, facilitating the delivery of content.

However, evidence from the current study suggests that teacher autonomy and control over their own curriculum and technical setup is also important. For example, it was observed that the constraints imposed by faculty or institution-wide choices of technical infrastructure, could limit teacher autonomy and control over their own curriculum. This had a potentially detrimental effect on technology integration given that teachers were unable to implement actions suggested through the PD program. Consequently, the careful selection of technical infrastructure is recommended as a design principle to inform other PD efforts in higher education (Table 9-1), although it is recognised that decisions about technology may be made by institutions rather than the teacher.

Focus on Teaching Practice

A focus on teaching practice was another key element of the PD program, but caution needs to be taken given the complexity of this element as implemented in the PD
program. For example, according to Kimberly and Pellegrino (2007) and Baran et al. (2016), the main objective behind a focus on teaching practice is to ensure pedagogical transformation of participants' teaching practice, and to move away from technology centric training. Evidence-based recommendations from the literature suggest delivering "know-how" and "know-why" (Albion et al., 2015), concentrating PD efforts in the participants' curriculum (Baran, 2016; Lehiste, 2015), and using a meaningful technology integration framework (Dysart and Weckerle, 2015). In the current study, TPACK was found to be a useful, pragmatic framework to understand technology integration. The learning technology by design approach was also found to be an effective way to implement TPACK-based PD (Mishra and Koehler, 2006). The focus on the design of participants' subjects allowed for in-depth reflection, visualization and evaluation of pedagogical approaches and selection of technologies, relevant to each participant's individual context. It also promoted ongoing conversations about the theory of learning. The collaborative evaluation and redesign of entire subject curricula is time and resource intensive, and therefore difficult to implement at scale. However, TPACK based workshops could focus on problematic aspects of participants' curricula (e.g learning tasks or assessments) or difficult, abstract topics in their subject. A focus on teaching practice is therefore recommended as a design principle to inform other PD efforts in higher education (Table 9-1).

Delivery Methods

Consideration of delivery methods is desirable to ensure an effective PD program, but needs to proceed with caution given the complexity of this element in terms of the resource intensive nature of the PD program used in the current study. The main objective of delivery is to move away from the seminar and knowledge transmission approaches (Ferman, 2002; Turkich et al., 2014). Evidence-based recommendations related to this element include establishing an environment creating conducive to deep learning through authentic, situated, hands-on-practice PD activities; creating sample blueprints to guide the redesign of subject curricula curriculum; and
providing continuous support and practice opportunities with technological tools. Evidence from the current study of a slow progression of knowledge and skills over a semester, supports the importance of moving away from the seminar approach to prevent beliefs and motivation being overlooked. Appropriate support for technology integration requires resources and time. To support self-efficacy, and to avoid overwhelming participants, a curriculum focused, gradual introduction of tools is required. Through each iteration of the current PD program, it became apparent that participants were more willing and able to enhance technology integration, if they were supported to feel comfortable with the use of one or two tools before introducing a new one. This is a similar finding to Mansvelt et al, (2008) who concluded that the gradual introduction of tools is necessary to avoid participants’ feeling overwhelmed due to cognitive load and low technological competency.

This finding also points to the value of sessions that concentrate on helping participants to start experimenting with new technological tools, and helping them configure the digital aspect of the tasks in their curriculum. The efficiency of this approach seemed to add value to the design consultations as they were perceived as focused workspaces, and led most participants to protect the time needed to properly engage in activities by scheduling sessions ahead of time.

Organizational culture

Organizational culture was found to be highly relevant to the effectiveness of the PD program. Yet it is a highly complex element given that it underpins all the other elements and involves a variety of influences, expectations, and variables within the higher education context. Evidence found in the literature recommends this element partly to ensure that PD efforts are perceived as a quality enhancement rather than quality management (Kennedy, 2014). Other evidence-based recommendations include conducting a needs analysis of participant’s performance (Owen, 2012; Willison, 2007), engaging stakeholders in developing a shared vision (Barnard et al.,
and aligning the program to institutional and national standards (Albion et al., 2015; Reeves, 1989). Although efforts were made to address all of these recommendation in the current program, engaging stakeholders in developing a shared vision is a complex endeavour given the limitation of time and cultural differences across faculties of a higher education institution. This is one of the reasons why voluntary participation was found to be essential to the effectiveness of the PD program. The benefits of voluntary participation ensured that participants were intrinsically motivated and had a positive predisposition to successfully complete and implement what they had learned in the PD program. However, McWilliams and Allan, (2014) argue that caution needs to be taken in view of the limitations of voluntary participation, such as the lack of incentives to ensure a time commitment from participants or recognition of improved teaching practice.

**Collaboration**

Finally, there is evidence in the literature to suggest that the benefit of collaboration is that PD outcomes are more likely to be sustained in the long term due to ongoing support (Ferman, 2002). Moreover, PD has been found to be more effective if it is a team-based activity (Mostert and Quinn, 2009). However, due to the limited number of participants in the current PD program, the element of promoting collaboration focused more on the collaboration between the researcher and the teacher rather than on establishing learning communities of practice or peer to peer networks. Nevertheless, participants reported that the one-on-one design consultations were influential in enhancing their TPACK competencies, triggering changes in beliefs, and improving self-efficacy. Consequently, this element cannot be recommended as a design principle based on the findings of the current study. Rather, collaboration is addressed as part of the delivery method.
9.1.1 Design principles

Five principles drawn from the study’s findings are presented here to inform the design of future PD programs to support technology integration in higher education. *Table 9-1* outlines each principle, provides a definition, and highlights key features of implementation. In addition, a series of recommendations have been developed to respond to the challenge of practicality, generalizability, and scalability, which are described in *Table 9-2*.

*Table 9.1 Recommended PD design principles to guide the design of the PD program for technology integration in higher education.*

<table>
<thead>
<tr>
<th>Principle</th>
<th>Definition and focus of PD</th>
<th>Key features of PD implementation</th>
</tr>
</thead>
</table>
| Promote reflective Practice | Reflective Practice enables teachers to understand their own beliefs. The objective is to create self-awareness in teachers as it can be a powerful motivator to enhance knowledge and competencies (Hativa and Goodyear, 2002). Awareness has also been observed to be a successful strategy for lowering cognitive-affective filters (Dydowicz, 2015). As a result of self-awareness, teachers can become motivated to improve their teaching through enhanced uses of technology. Reflective practice was also found to improve their confidence and knowledge to manifest these improvements in actions. | • Understand and respond to the needs of individuals.  
• Provide ongoing feedback.  
• Make explicit pedagogical beliefs, epistemological beliefs and value beliefs through evidence of performance, semi-structured interviews or continuous evaluation.  
• Support teachers to develop the habit of formative and summative evaluation of their subject  
• Evaluate changes as a result of PD. Have participants reflect and discuss results. |
| Focus on Teaching Practice | Focusing on participants’ immediate curriculum and individual teaching practice increases relevance and the likelihood of changes to be enacted in practice. | • Focus PD on tasks in the participant’s curriculum  
• Adopt a meaningful technology integration framework such as TPACK.  
• Deliver know-how and the know-why behind instructional methods |
| Consider Delivery Methods | The objective is to move away from the seminar and/or knowledge transmission approaches. Consider that common obstacles to effective PD delivery include failing to seek time commitment from participants, disconnected delivery from classroom practice, overlooking pedagogical beliefs and motivations, as well as lack of organization. | • Establish environments conducive to deep learning through authentic, situated, hands-on-practice PD activities  
• If the objective is to achieve visible changes in teaching practice, move away from the seminar and knowledge transmission approaches.  
• Ensure a focused and gradual introduction of technological tools. |
While the PD program developed and used in the current study had clear benefits for participants in relation to teaching practice and expertise in technology integration, the adoption of the proposed PD program in its current form across institutions would face constraints due to resources such as time, money, and the number of specialists required to provide such personalized support across large institutions. It is, therefore, critical to consider PD approaches for higher education that are practical, generalizable, and scalable. Table 9-2 presents recommendations to guide the implementation of the design principles described in Table 9-1 at scale.

Table 9.2 Design principles to guide the design of reflective PD programs for technology integration in higher education

<table>
<thead>
<tr>
<th>Principle</th>
<th>Stakeholder</th>
<th>Recommended actions for implementation</th>
</tr>
</thead>
</table>
| PD facilitator, academic developer, learning specialist | • Use collaborative, critical reflection of videotaped performance as an intrinsic part of Peer Review of Teaching practice, or as part of the PD framework implemented by your faculty.  
• Help teachers identify opportunities for formative evaluation |
<table>
<thead>
<tr>
<th><strong>Promote Reflective Practice</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Institutional or faculty leadership</strong></td>
</tr>
<tr>
<td>Use an assessment instrument to diagnose levels of knowledge, competencies, and beliefs.</td>
</tr>
<tr>
<td>Track the progress of teachers' beliefs and competencies through the PD. Make findings available to teachers. If possible, have teachers reflect and discuss findings.</td>
</tr>
<tr>
<td>Make available ongoing technical and pedagogical support.</td>
</tr>
<tr>
<td>Support teachers to develop the habit of evaluation through instruments such as a summative evaluation checklist.</td>
</tr>
<tr>
<td><strong>Promote self-reflection in collaboration:</strong></td>
</tr>
<tr>
<td>Promote the creation of learning communities of practice within faculties.</td>
</tr>
<tr>
<td>Use an assessment instrument to diagnose the competencies, knowledge, and beliefs of the teaching staff.</td>
</tr>
<tr>
<td>Consider collaborative, critical reflection of videotaped performance as an intrinsic part of Peer Review of Teaching practice, and as a component of performance reviews for promotions.</td>
</tr>
<tr>
<td>Adopt instruments such as summative evaluation checklists to guide teachers to evaluate their own subjects, in addition to the student satisfaction surveys.</td>
</tr>
<tr>
<td><strong>University teacher</strong></td>
</tr>
<tr>
<td>Support for Individual reflective practice:</td>
</tr>
<tr>
<td>Consider keeping a reflective journal of your teaching experience. Focus on identifying the signs of student learning such as what worked or didn't work during your lessons. The type of emails or questions you are receiving from students will help you identify improvements to your learning designs. Make a plan of action and apply those improvements to your learning designs.</td>
</tr>
<tr>
<td>Actively seek out feedback from your students on their learning experience.</td>
</tr>
<tr>
<td>Consider watching or listening to the lecture of one of your colleagues at least once a semester.</td>
</tr>
<tr>
<td>Evaluate your subject.</td>
</tr>
<tr>
<td><strong>Focus on Teaching Practice</strong></td>
</tr>
<tr>
<td><strong>PD facilitator, academic developer, learning specialist</strong></td>
</tr>
<tr>
<td>Plan workshops based on evaluating and enhancing participants' existing curriculum designs. The objective is to:</td>
</tr>
<tr>
<td>Review instructional materials looking for opportunities to enhance pedagogical approaches and the selection of technological tools relevant to curricular needs.</td>
</tr>
<tr>
<td>Use learning designs as a method have participants visualize and evaluate the effectiveness of their strategies in helping students achieve learning outcomes.</td>
</tr>
<tr>
<td>Consider using TPACK to conceptualize and operationalize PD efforts for technology integration.</td>
</tr>
<tr>
<td>Provide access to expert performances to exemplify the implementation of pedagogical strategies and uses of</td>
</tr>
</tbody>
</table>
### Consider Delivery Methods

<table>
<thead>
<tr>
<th>PD facilitator or designer / academic developer / learning specialist</th>
<th>technological tools relevant to their curricular needs, i.e. through videos or through the facilitator modelling instructional methods.</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Model the use of active learning methods in the delivery of workshops or design consultations.</td>
<td></td>
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<tr>
<td>• Focus workshops on having participant redesign their curricular tasks in collaboration.</td>
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<tr>
<td>• Use and promote cooperative, peer feedback strategies on learning designs.</td>
<td></td>
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<tr>
<td>• Suggest the use of reflective journals to help participants set actions plans for improvement at the end of each session.</td>
<td></td>
</tr>
<tr>
<td>• Identify tools that are relevant to the participants’ curriculum. Allocate 10-15 min of each session to have participants experiment with new or existing technological tools by guiding them to digitally configure one of their tasks.</td>
<td></td>
</tr>
<tr>
<td>• Wait for participants to feel comfortable with one or two technological tools before introducing another one.</td>
<td></td>
</tr>
<tr>
<td>• Provide ongoing technical and pedagogical support through collaborations with learning designers and/or learning specialists.</td>
<td></td>
</tr>
</tbody>
</table>

### Careful Selection of Technical Infrastructure

<table>
<thead>
<tr>
<th>PD facilitator or designer / academic developer / learning specialist</th>
<th>Explore affordances and limitations of technological tools prior to introducing them to both teachers and students.</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Consider creating a technological toolkit for teachers. This toolkit would include a list of institutionally approved tools, tutorials on how to use the tools, useful tips, sample tasks, and list of benefits of the tools.</td>
<td></td>
</tr>
<tr>
<td>• It is recommended to use a website to deliver PD content. Suggest teachers prepare for the workshop using the information on that website.</td>
<td></td>
</tr>
<tr>
<td>• Provide alternatives for teachers who lack control or autonomy over their own curriculum or technical infrastructure.</td>
<td></td>
</tr>
</tbody>
</table>

### Consider Organizational Culture and External Influences

<table>
<thead>
<tr>
<th>PD facilitator or designer / academic developer / learning specialist</th>
<th>Make participation in PD voluntary.</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Promote the creation of professional learning communities so a culture open to peer review and collaboration can be encouraged.</td>
<td></td>
</tr>
<tr>
<td>• Support teachers’ abilities to evaluate their subject by creating a simple but comprehensive evaluation checklist. Request teachers to submit this evaluation checklist as a complement to student satisfaction surveys. Make information available to teachers through a website or intelligent dashboard to support self-regulation.</td>
<td></td>
</tr>
<tr>
<td>• Support teachers to develop the confidence to actively seek out feedback on their teaching performance. Students are key stakeholders to the learning-teaching process.</td>
<td></td>
</tr>
<tr>
<td>Consider organizational culture and external influences</td>
<td>Institutional or faculty leadership</td>
</tr>
<tr>
<td>---------------------------------------------------------</td>
<td>-----------------------------------</td>
</tr>
</tbody>
</table>

**Recommendations for institutions**

- Develop an intelligent dashboard or website for teachers to track the progress of their competencies. This tool will enable a needs analysis to compare actual to desired performances. It will also help tailor PD tasks and will help focus administrative support.
- Adopt the practice of having teachers take a bi-yearly diagnostic of their competencies and beliefs. Keep track of their progress through an intelligent dashboard.
- Base Peer Review of Teaching on video recordings of actual in-class performance. Constructive feedback should be provided as a method to help the teacher reflect by watching themselves teach.
- Provide ongoing support. Ideally, this would include a couple of learning specialist in each faculty devoted to providing guidance and support to teachers within that faculty.
- Do consider teaching quality as part of performance reviews and promotions.
- Make a website available with evidence-based strategies, implementation tips, admin support, and technological support.
- Consider the creation of a technical toolkit

### 9.2 What influence does the PD program have on teachers’ pedagogical beliefs and understanding of the intersection between technological, pedagogical, content knowledge?

The current study investigated the link between pedagogical beliefs and TPACK competencies. The connection between these two constructs is relevant to PD given that teacher’s pre-existing beliefs about teaching, learning, students and the use of resources, can act as filters that will unconsciously inform pedagogical actions (Bender, Schaper, Caspersen, Margaritis, and Peter Hubwieser, 2016; Ertmer and Ottenbreit-Leftwich, 2010; Ottenbreit-Leftwich et al., 2010b). The tacit nature of beliefs can influence how teachers assimilate and enact knowledge (Ertmer, 2005); therefore, creating awareness of the beliefs that drive teaching practice was a guiding principle behind the design of the PD program. The strategic objective of creating self-awareness of beliefs was found to influence a change in teachers’ attitudes towards students and technological tools, as well as increased self-efficacy to perform in the teaching role.
However, a key finding of this study is that awareness of beliefs alone does not necessarily lead to visible changes in practice, unless the teacher is directly supported to have successful experiences with technology. Likewise, enhanced TPACK is unlikely to occur unless the teacher sees that knowledge as important to how they believe their discipline should be taught. The key is to expose pedagogical, epistemological and value beliefs so that teachers’ knowledge and self-efficacy can be supported, enabling changes in teaching practice to occur. This agrees with the work of Ertmer (2005) and Ertmer and Ottenbreit-Leftwich, (2010) that TPACK-based PD should incorporate, as a first step, strategies to enhance self-awareness of teaching practice. Once awareness is created, the PD facilitator can present pedagogical methods and technological tools relevant to their curriculum.

The findings of the current study support the work of Hativa and Goodyear (2012) who affirm that to change teaching practice, teachers need to become aware of their “underlying assumption, values and attitudes” (p. 343). By using this reflective approach, the current study also directly responded to Kandlbinder and Peseta, (2009) who urged the academic community to use the scholarship of teaching (SoT) to turn the classroom into a site for research and inquiry.

As belief systems are interconnected (Ertmer, 2005; Kagan, 1992), an in-depth understanding of the complexity of teaching practice requires a broader investigation of the intrinsic and cognitive components that inform pedagogical actions. The current study provided insights into four cognitive or affective filters. Motivation was found to influence intentions; self-efficacy was found to inform an individual’s perception of their ability to integrate technology; value beliefs were found to help determine the effort invested in an activity based on perceptions of relevance; and epistemological beliefs were found to inform the relevance of pedagogical approaches, technological tools or resources based on the nature of a discipline. Due to their nature, every one of these intrinsic individual characteristics, including pedagogical beliefs, can become obstacles to technology
integration practices. Consequently, one of the key insights of the current study is that belief systems can have a greater influence on teaching practice than knowledge. Ottenbreit-Leftwich et al. (2010) and Pajares (1992) also found that teacher beliefs have more influence in teaching practice than specific knowledge given that teachers’ daily decisions can be based on what they believe. It is thought this is due to beliefs being subjective explanation systems often informed by personal evaluation and judgment, as opposed to objective, factual knowledge (Khader, 2012; Pajares, 1992; Petko, 2012). As Ertmer (2005) eloquently highlights, “after gaining knowledge of a proposition, we are still free to accept it as being either true or false (i.e., believe it, or not)” (p. 28).

In relation to TPACK, evidence from the current study suggests that fit can result in enhanced learning designs that are conducive to the facilitation of deeper learning approaches in students. Moreover, the concept of fit promotes a more meaningful way to conceptualize technology integration. However, Agostinho et al. (2013) and Chai, Chin, Koh, and Tan (2013) found that when teachers are challenged with the design of a task or subject, they will focus on PK first because of the perceived relevance and confidence with the methods of teaching the content of their discipline. Teachers are, however, less confident with the design of tasks that employ technological tools, suggesting that fit is a long-term goal. More importantly than fit, what seems critical for PD for technology integration in higher education is the support of Pedagogical Content Knowledge (PCK) and Technological Pedagogical Knowledge (TPK). Janssen and Lazonder (2016) suggest that there are three ways to help teachers develop fit through PCK, via TPK, or via TPK and PCK.
9.3 What is the influence of the PD program on university teachers’ effective implementation of educational technology in their teaching practice?

The most profound finding from the current study is the influence of creating awareness of the beliefs that drive teachers’ practice, and the influence of this awareness on intentions for technology integration. Awareness of personal approaches to teaching was found to be a powerful motivator to enhance knowledge; it was also seen to prime teachers to new possibilities with technology, specifically in terms of increasing cognitive and social engagement in students, and automating administrative duties. This finding adds support to the work of Kim, et al, (2013) who report, “…that teacher’s beliefs about the nature of knowledge and learning and beliefs about effective ways of teaching were related to their technology integration practices” (p.82).

The process of creating awareness involves guiding participants to articulate their beliefs and to subsequently evaluate if those beliefs manifest in their desired pedagogical actions. This resulted in an increased willingness in participants to innovate their practice by reviewing the pedagogical basis behind their current use of technological tools, or by adopting new tools. Because of the longitudinal nature of the PD program, there was enough time to share the findings of the assessment instruments and confidence logs with participants, allowing them to identify how their beliefs influenced their knowledge, and in turn how their knowledge was enacted in the classroom. The study provided strong evidence that teachers’ awareness of their beliefs and intrinsic individual characteristics had the potential to close the gap between espoused beliefs and knowledge to be enacted in practice. Ertmer et al., (2012) reported similar findings after examining the technology integration practice of 12 K-12 teachers using document analysis and interviews, reporting that “teachers were able to enact technology integration practices that closely aligned to their beliefs…although teachers could articulate their beliefs, practices were influenced by “classroom realities” (p.432).
In regards to technology integration, a noteworthy finding is that the number of years of teaching practice was not indicative of high uses of technology use. In the current study, cases 2, 3, 7 and 8, had between seven and fifteen years of experience, and initially, they all used technology mainly for communication in the form of announcements and as a submission tool for assessment tasks (traditional uses of technology). A similar finding was reported by Norton et al., who argued that there was little evidence to support the notion that teaching conceptions change with experience. Instead, they found evidence to suggest that “...teachers approach to teaching, such that with increasing experience these became more aligned with teachers’ perceptions of the academic context” (pp 557-558). Rienties et al., (2013) also reported the difficulty in changing the attitudes of experienced teachers towards student-centred approaches given their confidence in their current approach. However, findings from the current study suggest that the reflective approach of the PD program had a positive influence with both novice and experience teachers.

Student-centred beliefs were also found to be unreliable indicators of high uses of technology in this study. Case 5, for example, had the most flexible, student-centred beliefs, yet her preference for manual methods led to a conscious decision to only implement low uses of technology.

Although the number of participants in the current study is not large enough to make any generalisations, what can be inferred is that the quality of subject learning designs seems to be a better indicator of high uses of technology. For example, in cases 3 and 4, as more awareness of their attitudes towards technology was created, and the more their learning designs improved, a higher quality of technology integration occurred. Moreover, positive pre-dispositions seem conducive to high uses of technology. For example, the passion for gaming of case 9, the positive student experiences in a fully online context of case 6, the familiarity with technological gadgets of case 1, and the identity beliefs as a technology expert of case 4, all seemed to influence their tendencies for high uses of technology.
9.4 Limitations

The current study had a number of limitations. One limitation is the number of cases examined in the study. Given the length of engagement and the depth of analysis undertaken, it only was possible to study nine cases. This allows for informed inferences to be made, but no generalizations can be presented.

Another limitation regards the in-class observations. Although the third iteration of the PD program included two observations throughout the semester, most case studies were based on just one observation. This allowed for a snapshot of actual teaching practice from which assumptions were derived, which could lead to misrepresentations or superficial assumptions of pedagogical actions throughout the semester. However, in-class observation data was complemented with a focus group, learning designs, LMS statistics and interviews from participants.

A third limitation of the study relates to the need for the literature review to include the k-12 and vocational contexts. Even if the purpose was to identify a more thorough understanding of general PD models and approaches, this may be found to be problematic by some researchers in the field given the different dynamics in each context. As already explained, research on TPACK-based models is richer in the K-12 context.

It is also worthwhile noting that in the current study the researcher was also the facilitator of the PD program and this may be found to be problematic by some researchers in the field. As explained in Chapter 6, some of the benefits of Design Based Research are that it allows for this dynamic to happen. However, it should be noted that the researcher did not know any of the participants prior to their engagement in the PD program and other than a research interest, had no other interest in the programs being investigated.
9.5 Recommendations for future research

The current study laid out the roots for future research. An exciting possibility is to further investigate the link between TPACK and pedagogical beliefs. This is largely uncharted territory for research and offers a novel opportunity to provide a more in-depth understanding of the elements that influence teaching practices. It could also inform more innovative PD solutions.

Another exciting possibility is to further investigate strategies to support the alignment between espoused beliefs, knowledge and teaching practice. More understanding is required about the process of how espoused beliefs inform and guide pedagogical decisions.

9.6 Conclusion

This program of doctoral research set out to design a PD program for technology integration after identifying six critical elements from the literature. The PD program was then implemented over three iterations and mixed methods were employed to assess PD outcomes. Nine case studies of university teachers who participated in the PD program were examined. The influence of the PD program on university teachers’ beliefs, TPACK and technology integration practice was investigated based on data that captured what they think, what they know and what they actually do in their teaching practice.

The findings of this study suggest that the PD program was effective in creating awareness, which influenced a shift in pedagogical beliefs towards more student-centred intentions across eight out of nine case studies. Value beliefs, epistemological beliefs, and self-efficacy beliefs were also identified as important considerations for the design of future PD programs for technology integration. These beliefs systems are intrinsic characteristics of an individual that appear to influence pedagogical decisions and actions. Belief systems and knowledge constructs both exert direct influence on teaching practice, however, the findings of
this study support the work of Pajares (1992) who proposed that beliefs may have a greater influence on teaching practice than knowledge. The findings of the current study also strongly align with the work of Ertmer (2005) who highlights that due to their tacit, episodic and unbounded nature, teacher beliefs may act as obstacles to technology integration practices. Moreover, Hativa and Goodyear (2002) argue that “teacher’s lack of awareness of the sources of their actions may pose a threat to their practice” (p. 343). It is therefore, concluded, that teacher beliefs are a critical consideration in the design of PD programs to support technology integration practices, and that their oversight may act as a barrier to the sustainability of successful PD outcomes over the long term.

When it comes to TPACK, the PD program had a strong influence on Technological Pedagogical Knowledge (TPK), which manifested as an increase in pedagogically informed uses of educational technology. The Learning Technology by Design approach originally proposed by Mishra and Koehler (2006) was also found to be an effective method for TPACK-based PD in higher education due to the focus on teachers’ curricular designs. However, it is important that a balance is struck between the use of diagnostic surveys, self-reports and other data collection methods to counter potential inaccuracies caused by the Dunning Kruger effect (Dunning, 2011). In the current study, this effect was identified as a pattern across case studies.

As a result of the PD program, participants also reported enhanced self-efficacy in their pedagogical knowledge which seem to be related to an increase in self-efficacy in teaching competencies. There were also visible influences of the program on actual teaching practice which reflected an improved implementation of pedagogical approaches and an increased use of technological tools in seven out of nine cases.

In summary, the contributions of the current study include the development of a PD program found to be effective in influencing pedagogical beliefs and technology
introduction practices. Given the intensive nature of the current PD program and implications for wide spread use in the higher education context, design principles to inform the design of reflective PD programs have been developed, from which recommendations for the implementation of such programs have been drawn.

The findings of this study urge PD facilitators to move away from de-contextualised, one-size-fits-all knowledge-transmission focussed PD offerings, and instead implement more reflective PD that aims to support teaching practice and technology integration through a focus on learning design. The study also highlights the importance of recognizing that pedagogical beliefs are conceptualized as a continuum between student and teacher-centred approaches, rather than a dichotomy.

The current study has provided the basis for future research and the development of future PD solutions. An exciting possibility is to further investigate the link between TPACK and pedagogical beliefs. This is an uncharted territory of research and offers a novel opportunity to provide a more in-depth understanding of the elements that influence teaching practice.
10 References


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Malik, S. (2014). Effectiveness of ARCS Model of Motivational Design to Overcome Non Completion Rate of Students in Distance Education. *Turkish Online Journal of Distance Education*, 15(2), 194-200.


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## 10.1 Appendixes

### Table 10.1 Appendix A: List of articles from which the six elements that informed the design of the PD program arose

(for more information refer to chapter 2).

<table>
<thead>
<tr>
<th>Key design themes for PD for technology integration in higher education</th>
<th>Articles that suggest the themes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Promote Reflective Practice</strong></td>
<td>Kennedy (2014) (1)</td>
</tr>
<tr>
<td><strong>A focus on Teaching Practice</strong></td>
<td>Albion et al. (2015) (2)</td>
</tr>
<tr>
<td><strong>Consider Delivery methods</strong></td>
<td>Ertmer (2005) (3)</td>
</tr>
<tr>
<td><strong>Selection of Technical Infrastructure</strong></td>
<td>Ertmer et al. (2012) (4)</td>
</tr>
<tr>
<td><strong>Organizational Culture</strong></td>
<td>Kagan (1992) (5)</td>
</tr>
<tr>
<td><strong>Promote Collaboration</strong></td>
<td>Norton et al. (2005) (6)</td>
</tr>
</tbody>
</table>

- **Harris and Jones** (2010) (26)
- **Kandlbinder and Peseta** (2009) (27)
- **Lehiste** (2015) (28)
- **Huber** (1991) (29)
- **Lawless and Pellegrino** (2007) (31)
- **Du Plessis and Webb** (2012) (32)
- **Baran** (2016) (33)
- **Rientes et al.** (2013) (34)
- **Uslu** (2012) (35)
- **Dysart and Weckerle** (2015) (36)
- **Albion et al.** (2015) (37)
- **Orchard et al.** (2014) (38)
- **Rientes et al.** (2014) (39)
- **Ferman** (2002) (40)
- **Wilson** (2012) (41)
- **Campbell et al.** (2015) (42)
- **Conole and Jones** (2010) (43)
- **van Merrienboer et al.** (2002) (44)
- **Bath and Smith** (2004) (45)
- **Dysart and Weckerle** (2015) (46)
- **Turkich et al.** (2014) (47)
- **Terkulich et al.** (2014) (48)
- **Baran** (2016) (49)
- **Du Plessis and Webb** (2012) (50)
- **Schmidt et al.** (2009) (51)
- **Jacqui et al.** (2011) (52)
- **Dysart and Weckerle** (2015) (53)
- **Albion et al.** (2014) (54)
- **Wilson** (2012) (55)
- **Campbell et al.** (2015) (56)
- **Okseon and Euihang** (2015) (57)
- **Mansvelt et al.** (2008) (58)
- **Valanides and Angel** (2005) (59)
- **Wang et al.** (2014) (60)
- **Baran** (2016) (61)
- **Conole and Jones** (2010) (62)
- **Campbell et al.** (2015) (63)
- **Barnard et al.** (2015) (64)
- **Rodrigues** (2005) (65)
- **McWilliams and Allan** (2014) (66)
- **Training** (2015) (67)
- **Wilison** (2007) (68)
- **Kennedy** (2014) (69)
- **Albion et al.** (2015) (70)
- **Owen** (2012) (71)
- **Huber** (1991) (72)
- **Parr and Timperley** (2010) (73)
- **Dysart and Weckerle** (2015) (74)
- **Jacqui et al.** (2011) (75)
- **Bath and Smith** (2004) (76)
- **Mansvelt et al.** (2000) (77)
- **Wang et al.** (2014) (78)
- **Valanides and Angel** (2005) (80)
- **Grainger et al.** (2015) (81)
- **Joyce and Calhoun** (2010) (82)
- **Calhoun et al.** (2015) (83)
- **Gooparian et al.** (2015) (84)
- **Cochrone et al.** (2013) (85)
- **Robinson et al.** (2014) (86)
- **Woodman and Parappilly** (2015) (87)
- **Fawns et al.** (2005) (88)
- **Hamilton et al.** (2013) (89)
- **Martinez et al.** (2005) (90)
- **Mostert and Quinn** (2009) (91)
- **Singh** (2014) (92)
- **Turkic et al.** (2014) (93)
- **Wang et al.** (2014) (94)
- **Du Plessis and Webb** (2012) (95)
- **Dysart and Weckerle** (2015) (96)
- **Farnes et al.** (2015) (97)
- **Lawless and Pellegrino** (2007) (98)
- **Schmidt et al.** (2009) (99)
- **Baran** (2016) (100)
- **Draper et al.** (1996) (101)
- **Hannanin and Peck** (1998) (102)
- **Lehiste** (2015) (103)
- **Du Plessis and Webb** (2012) (104)
- **Turkic et al.** (2014) (105)
- **Hattie** (2011) (106)
Table 10.2 Appendix B: Coding framework used to analyse interviews with participants of the PD program

<table>
<thead>
<tr>
<th>What I think (Beliefs)</th>
<th>What I know (knowledge)</th>
<th>What I do (practice)</th>
</tr>
</thead>
<tbody>
<tr>
<td>THINK/Individual Beliefs and Values/Subjective Understanding: Personal</td>
<td>KNOW/Competencies/Objective understanding: Factual propositions</td>
<td>DO/implementation</td>
</tr>
<tr>
<td>Value</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Positive</td>
<td>• T</td>
<td>• Task/activities</td>
</tr>
<tr>
<td>• Negative</td>
<td>• P</td>
<td>• Resources</td>
</tr>
<tr>
<td>Assumptions</td>
<td>• C</td>
<td>• Supports</td>
</tr>
<tr>
<td>Knowledge acquisition</td>
<td></td>
<td>• Alignment</td>
</tr>
<tr>
<td>Teacher role</td>
<td></td>
<td>• Objectives</td>
</tr>
<tr>
<td>Student ability</td>
<td></td>
<td>• Assessment</td>
</tr>
<tr>
<td>Interactions</td>
<td></td>
<td>• feedback</td>
</tr>
<tr>
<td>Outcomes</td>
<td></td>
<td>• Evaluation</td>
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<tr>
<td>Teacher Centred</td>
<td></td>
<td>• Enacted curriculum</td>
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<tr>
<td>Student Centred</td>
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<td>Espoused</td>
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<tr>
<td>Methods</td>
<td></td>
<td>Influences</td>
</tr>
<tr>
<td>• Problem Based Learning</td>
<td></td>
<td>• PD program</td>
</tr>
<tr>
<td>• Project Based Learning</td>
<td></td>
<td>• Internal</td>
</tr>
<tr>
<td>• Case Based Learning</td>
<td></td>
<td>• motivation</td>
</tr>
<tr>
<td>• Peer instruction</td>
<td></td>
<td>• self-efficacy</td>
</tr>
<tr>
<td>• Guided discovery</td>
<td></td>
<td>Organization/institution</td>
</tr>
<tr>
<td>• Collaborative Learning</td>
<td></td>
<td>• Rules/policies</td>
</tr>
<tr>
<td>• Cooperative Learning</td>
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<td>• Job expectations</td>
</tr>
<tr>
<td>• Authentic Learning</td>
<td></td>
<td>• Peers</td>
</tr>
<tr>
<td>• Game-based learning</td>
<td></td>
<td></td>
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<tr>
<td>• Simulation-based learning</td>
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<tr>
<td>• Roleplay</td>
<td></td>
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<tr>
<td>• Self-directed learning</td>
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<tr>
<td>Influences</td>
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<tr>
<td>• Good quotes</td>
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<tr>
<td>Future plans</td>
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</tbody>
</table>
10.3 - Appendix C: TPACK and Pedagogical beliefs assessment instrument.

Click on the icon to download the final version of the TPACK and Pedagogical Beliefs assessment instrument as configured in Google Forms.

TPACK and Beliefs Questionnaire -.pdf
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Author/s:
Conde Hernandez, Lis Maria

Title:
A beliefs centred professional development program to support the use of educational technology

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2019

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