Building ICT Capacity by Design: A Community of Practice Approach for Teacher Professional Development

Stuart PR Duvall
BSc, GradDipEd, MEd

Thesis presented for partial completion for the degree of Doctorate of Education, Murdoch University
2019
Declaration

I declare that this thesis is my own account of my research and contains as its main content work which has not previously been submitted for a degree at any tertiary education institution.

Stuart Duvall
Abstract

This thesis is the report of a two-year study that examined how participation in a community of practice could support teachers’ collective efficacy beliefs about their information and communication technology (ICT) capabilities. To explore the relationship between community of practice participation, collective efficacy beliefs and ICT capabilities, an intervention was carried out at an independent co-educational secondary school located in suburban Western Australia. The design-based research approach guided this research and provided a methodology that could bridge the chasm between developing theory and practice. A case study methodology was used to collect and analyse data on the factors supporting the co-construction of collective efficacy beliefs. The initial phase of the investigation involved the researcher collaboratively working with teachers to identify and explore personal experiences using digital technology and a review of the literature. Informed by the initial phase, the second phase resulted in the development of draft design principles, grounded in theory, to guide the ensuing intervention. In the third phase, an intervention was introduced in the form of a community of practice to enhance teachers’ ICT capabilities. During this third phase, the original design principles were enhanced through two iterative cycles of testing and refinement. Again, the testing and refinement of the design principles involved consultation with the teachers participating in the intervention. The fourth phase presents a final set of refined design principles, which can be used by schools seeking to support teachers’ collective efficacy beliefs through professional development and learning. This study found that direction-setting leadership practices were the most significant factor in supporting collective efficacy or collective inefficacy. Despite direction-setting leadership practices that supported a collective inefficacy, the community of practice participants were able to maintain their teacher self-efficacy beliefs in the medium term.
I would like to express my sincere gratitude to my first Principal Supervisor, Professor Jan Herrington, for her valuable and constructive guidance through each stage of this research project. The ability to see positives in every situation and the enthusiasm she has for her research was contagious and motivational for me. Furthermore, a willingness to generously give her time in retirement to support me has been abundantly appreciated.

I also wish to express deep feelings of gratitude towards my second Principal Supervisor, Associate Professor Judy MacCallum. I am, indeed, grateful for her tremendous support, useful guidance and attention to detail. A willingness to always provide constructive feedback helped me to develop a broader perspective in my thesis.

Finally, my heartiest thanks go to my family. I wish to thank my parents, Susan and Roy, and my extended family for enduring my doctoral studies, which, at times, impacted my participation in family engagements. Also, I would like to especially acknowledge Margo Devoto and Wesley Devoto, OBE, who instilled a belief in me that I could take an academic path in life and provided me with the opportunity to begin my journey. Above all, I wish to thank my wife, Kiara, for her support, patience and enduring encouragement that allowed me to realise an important personal goal. To my four children, Scarlett, Hunter, Myra and Tabitha, who have only known a father who was always working on his doctorate – I thank you for your patience and each distraction that reminded me that I am part of an extraordinary family.
# Table of Contents

Chapter 1: Introduction.............................................................................................................. 1  
  Background to the study ......................................................................................................... 2  
  Factors influencing ICT use.................................................................................................... 3  
  Enriching students’ learning ................................................................................................. 4  
  Government policy .................................................................................................................. 6  
  Increases in digital technologies ............................................................................................ 7  
  Professional learning ............................................................................................................. 8  
  Collective efficacy .................................................................................................................. 10  
  Purpose of the study ............................................................................................................... 11  
  Research question .................................................................................................................. 13  
  The significance of the research ............................................................................................ 14  
  Research design .................................................................................................................... 14  
  The organisation of the thesis ............................................................................................... 15  

Chapter 2: Literature Review.................................................................................................... 17  
  Perspectives on learning .......................................................................................................... 17  
  Communities of practice ......................................................................................................... 18  
  Development of collective efficacy ....................................................................................... 23  
  Self-efficacy beliefs ................................................................................................................ 24  
    Mastery experience ............................................................................................................. 24  
    Vicarious experience .......................................................................................................... 25  
    Social persuasion ................................................................................................................ 26  
    Psychological factors ......................................................................................................... 26  
    Collective efficacy ............................................................................................................. 27  
  Guiding conceptual framework ............................................................................................... 31  
  Gaps in the literature ............................................................................................................. 32  
  Potential design principles .................................................................................................... 34  
    Communities of practice .................................................................................................. 34  
    Efficacy theory .................................................................................................................... 37  
  Summary ................................................................................................................................. 40
Chapter 3: Methodology .............................................................................. 41

Design-based research approach .................................................................. 41
Characteristics of design-based research ...................................................... 42
The rationale for the research approach ......................................................... 44
Reeves’s (2006) design research model ......................................................... 45
Nature of the study ...................................................................................... 46

Phase 1: Analysis of the practical problem by researcher and practitioner in collaboration ........................................................................................................ 46

Stages of ICT learning framework ................................................................ 47

Phase 2: The development of solutions informed by existing design principles and technological innovations ................................................................. 49

Phase 3: Iterative cycles of testing and refinement of solutions in practice ...... 51

Participants .................................................................................................. 51

Research participants ................................................................................. 52
Participant: Melissa ..................................................................................... 53
Participant: Carol ......................................................................................... 53
Participant: Enoch ....................................................................................... 53
Participant: Sung-ho ................................................................................... 54
Participant: Jason ....................................................................................... 54

Method of evaluation .................................................................................. 54

Data collection methods ............................................................................ 55

Initial survey ............................................................................................... 56
Semi-structured interview: Iteration 1 ......................................................... 56
Semi-structured interview: Iteration 2 ......................................................... 57

Administration of the instruments ................................................................ 58

Data analysis methods ............................................................................... 58

Stage 1: Comparing incidents applicable to each category ......................... 59
Stage 2: Integrating categories and their properties .................................... 61
Stage 3: Delimiting the theory ..................................................................... 63
Stage 4: Writing the theory ........................................................................ 65

Trustworthiness and credibility ................................................................. 65

Informed consent and the minimisation of harm ....................................... 65

Benefits of the research ........................................................................... 66
Note on the editing of quotes

Phase 4: Reflection to produce ‘design principles’ and enhanced solution implementation

Summary

Chapter 4: Design of the Learning Environment

Issues guiding the design of the intervention

Researcher roles

Technology stewardship

Core member

Friend and colleague

Collective efficacy learning framework in practice

Facilitate an open dialogue between inside and outside perspectives

Invite different levels of participation from the participants

Develop both public and private spaces for members to communicate

Promote the value of membership to the community

Provide the community with learning experiences that promote the development of ICT capabilities and collective efficacy beliefs

Create a rhythm for the community members’ interactions

Pre-intervention

Intervention: Community of practice

Post-intervention

Reflections on the draft design principles – Iteration 1

Technology steward’s reflections

Recommended improvements

Reflections on the draft design principles – Iteration 2

Technology steward’s reflections

Recommended improvements

Summary

Chapter 5: Data Analysis – Digital Pedagogy

Background use of educational technology

First iteration: Digital pedagogy

Classroom management
ICT capability ................................................................. 88
Technological pedagogical knowledge .................................. 89
Digital pedagogy and co-construction of collective efficacy ............. 90
Second iteration: Digital pedagogy .......................................... 92
  Classroom management ...................................................... 92
  ICT capability ....................................................................... 94
  Resources ............................................................................ 96
  Digital pedagogy and the co-construction of collective efficacy ............ 98
Summary .................................................................................. 98

Chapter 6: Data Analysis – Direction-Setting Leadership Practices .......... 101
  Legitimate role ........................................................................ 102
  First iteration ............................................................................ 104
    Teaching conditions ............................................................... 104
    Technology resources ............................................................ 106
    School climate ....................................................................... 108
    Antecedents .......................................................................... 108
    Power ................................................................................... 109
    Principal’s influence .............................................................. 111
    Brokering ............................................................................ 112
    Rewards and recognition ....................................................... 112
    Direction-setting leadership practices and collective efficacy beliefs ...... 113
  Second iteration ........................................................................ 113
    Teaching conditions ............................................................... 114
    Technology resources ............................................................ 117
    Access to digital content ....................................................... 117
    Ageing infrastructure ............................................................ 121
    School climate ....................................................................... 122
    Enterprise agreement negotiations ......................................... 123
    Brokering ............................................................................ 123
    Power ................................................................................... 126
    Rewards and recognition ....................................................... 127
    Professional learning and development .................................... 128
    Direction-setting leadership practices and collective efficacy beliefs ...... 130
Summary ................................................................................................................. 130

Chapter 7: Conclusion and Implications ................................................................. 133
  Overview of the study .......................................................................................... 133
  Research question and findings ......................................................................... 136
    Research question ............................................................................................ 136
    Design principles ............................................................................................ 138
  Limitations of the study ...................................................................................... 141
  Implications for the research ............................................................................. 142
  Recommendations for future research ................................................................. 143

References .............................................................................................................. 145

Appendix A: The stages of teacher ICT learning (Schibeci et al., 2008) .............. 156
Appendix B: Information letter and participant consent forms .............................. 158
Appendix C: Initial semi-structured survey questions ............................................ 162
Appendix D: Questionnaire context matrix ............................................................ 165
Appendix E: Second semi-structured interview questions ..................................... 168
Appendix F: Third semi-structured interview schedule .......................................... 170
Appendix G: ICT CoP email ................................................................................. 173
Appendix H: ICT CoP meeting agenda ................................................................. 176
List of Tables

Table 1.1: Application of digital technology at Heron College ........................................ 4
Table 2.1: Wenger’s learning architecture (1988, p. 40) ....................................................... 35
Table 2.2: Collective efficacy theory .................................................................................. 38
Table 2.3: Collective efficacy learning framework ............................................................... 39
Table 3.1: Anderson and Shattuck’s (2012) eight basic features of design-based research .................................................................................................................. 50
Table 3.2: Sample conditional relationship guide ................................................................. 62
Table 3.3: Sample reflective coding matrix ............................................................................ 64
Table 3.4: Procedures to ensure validity ............................................................................... 67
Table 4.1: Iteration 1 – Issues and recommendations ......................................................... 78
Table 4.2: Iteration 2 – Issues and recommendations ........................................................... 81
Table 5.1: Teachers’ background use of ICT ....................................................................... 85
Table 5.2: Motivation for participating in the ICT Community of Practice ..................... 88
Table 6.1: Comparison of the School’s strategic plan and the aims of the ICT Community of Practice .............................................................................................................. 103
Table 7.1: Collective efficacy learning framework ............................................................... 141
List of Figures

Figure 2.1: Guiding conceptual framework ................................................................. 31
Figure 3.1: Reeves’ (2006) design-based research model (p. 59) .............................. 45
Figure 3.2: Outline of data collection events and methods ........................................ 55
Figure 3.3: Data analysis schematic ........................................................................... 59
Figure 3.4: Data coding example .............................................................................. 60
Figure 3.5: Memo examples ...................................................................................... 60
Figure 5.1: Overview of the data analysis .................................................................. 84
Figure 7.1: Overview of how the four phases of the design-based research approach were implemented in this study ............................................................................. 135
Figure 7.2: Sociocultural model of collective efficacy beliefs from community of practice participation ........................................................................................................ 139
## List of abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACARA</td>
<td>Australian Curriculum, Assessment and Reporting Authority</td>
</tr>
<tr>
<td>CATLM</td>
<td>Cognitive-affective theory of learning with media</td>
</tr>
<tr>
<td>DBR</td>
<td>Design-based research</td>
</tr>
<tr>
<td>DVD</td>
<td>Digital versatile disc</td>
</tr>
<tr>
<td>EPICT</td>
<td>European Pedagogical Information and Communication Technology</td>
</tr>
<tr>
<td>HC ICT CoP</td>
<td>Heron College ICT CoP</td>
</tr>
<tr>
<td>ICT</td>
<td>Information and communication technology</td>
</tr>
<tr>
<td>ICT CoP</td>
<td>Information and Communication Technology Community of Practice</td>
</tr>
<tr>
<td>IT</td>
<td>Information technology</td>
</tr>
<tr>
<td>K–12</td>
<td>Kindergarten to Year 12</td>
</tr>
<tr>
<td>LMS</td>
<td>Learning management system</td>
</tr>
<tr>
<td>MDEGYA</td>
<td>Melbourne Declaration on Educational Goals for Young Australians</td>
</tr>
<tr>
<td>MOOC</td>
<td>Massive open online course</td>
</tr>
<tr>
<td>NAPLAN</td>
<td>National Assessment Program – Literacy and Numeracy</td>
</tr>
<tr>
<td>OECD</td>
<td>Organisation for Economic Co-operation and Development</td>
</tr>
<tr>
<td>OLNA</td>
<td>Online Literacy and Numeracy Assessment</td>
</tr>
<tr>
<td>PD</td>
<td>Professional development</td>
</tr>
<tr>
<td>PISA</td>
<td>Programme for International Student Assessment</td>
</tr>
<tr>
<td>TPCK</td>
<td>Technical pedagogical content knowledge</td>
</tr>
<tr>
<td>WA</td>
<td>Western Australia</td>
</tr>
<tr>
<td>WACE</td>
<td>Western Australian Certificate of Education</td>
</tr>
</tbody>
</table>
Preface

At the beginning of this study, I taught in a technology-rich secondary school, Heron College (pseudonym). During my time teaching at Heron College, I observed that even the most experienced and adept teachers typically exhibited limited effectiveness when incorporating educational technologies into their teaching practices. This observation provided the catalyst for a doctoral research project that adds another dimension to the literature on how school-based factors can influence teachers’ information and communication technologies (ICT) professional learning and how these factors can influence the co-construction of collective efficacy beliefs for incorporating ICT into teaching practices. Furthermore, this research project presents a framework to support teachers’ professional learning through a community of practice approach that can be used by school leaders seeking to improve student learning through enhancing teachers’ ICT capabilities and in so doing develop a school culture that promotes learning.
Chapter 1:
Introduction

Over the last three decades, Australian schools have experienced an increase in the variety and availability of Information and Communication Technologies (ICTs). This increase has presented many opportunities to improve teaching and learning (Lefebvre, Deaudelin, & Loiselle, 2006) as well as positively influence student motivation (Cooper & Brna, 2002). Furthermore, educators play an important role in preparing students to become productive, digitally literate members of a society that is rich in technology and digital content. Even if the term “21st century learner” is becoming a cliché, it differentiates the learning needs and possible learning experiences of today’s students from their predecessors. For example, today’s students can participate in Massively Open Online Courses (MOOCs), complete their work on digital mobile devices, and access digital content via high-speed Internet connections. These resources provide students with a seemingly endless supply of content to enrich and support their learning. Such resources were not as accessible to students a decade ago and will no doubt soon be superseded by the likes of virtual learning experiences if the current pace of digital progress continues.

This chapter introduces the reader to the present study by describing how ICT has become a significant part of teachers’ professional practices in recent years and argues that even though ICT has had a classroom presence for the last 30 years, teachers need support with integrating ICT into the learning environment. The chapter then discusses how participation in ongoing professional learning is more effective than attending the one-off seminars and workshops that are the hallmarks of professional development. The next section summarises the benefits that can arise from nurturing teachers’ collective efficacy beliefs as they engage in professional learning. After the background to this study has been advanced, the chapter discusses the purpose of the study, the research question, and the significance of the research. The chapter concludes with a brief discussion of the research design and organisation of the thesis.
Background to the study

When Heron College opened to students in the early 2000s, it provided a modern learning environment for that time. The new buildings had a modern architectural appeal, and the College was resourced with a wide range of digital technologies. The presence of a new College attracted many visitors who were frequently treated to walking tours of the College campus. The tour included visiting the impressive lecture theatre, and an inspection of the classrooms housing interactive whiteboards and new computer labs. When the tours coincided with the school operations, students and teachers could be seen engaged in learning using the College’s digital resources such as DVD players, video cameras, audio recording devices, digital cameras, data collectors, video streaming services and the learning management system (LMS). After a decade had passed, visitors were still treated to the same tour; however, the showcasing of technology had declined in comparison to the earlier years. From observing my peers, I noticed that teachers were making limited use of or disregarding the range of digital resources available to them. Having access to digital technology did not automatically result in teachers and students making effective use of the resources available to them. I found these observations concerning, and so began my enquiry into how to support teachers’ ICT practices effectively.

To begin exploring the scope of this real-world problem, I met with the teachers of Heron College to discuss their experiences of using ICT in the classroom, observed teachers’ ICT practices, and examined teachers’ survey responses to an evaluation of the College strategic plan. An advertising agency contracted by Heron College conducted the survey, and the results were made public to all staff. These sources revealed the emergence of eight themes relating to teachers’ use of technology that could be grouped into two categories of use:

1. The applications of digital technology:
   - presentations,
   - the production of electronic resources,
   - record management, and
   - electronic communications.
2. Impediments to digital technology use:
   - a perceived lack of professional development,
   - challenges with technology integration,
   - time limitations, and
   - the requirement to use digital technology that was difficult to use.

From the initial exploration, it was evident that teachers at Heron College were incorporating ICT into their teaching practices; however, it was predominantly used to support direct instructional practices. Furthermore, the teachers felt there was a deficit in their ICT capabilities, and to address this issue they desired access to quality, in-depth, more purposeful learning opportunities.

**Factors influencing ICT use**

After the initial informal exploration of the research site revealed two categories, the research literature was explored for articles that pertained to teachers’ motivation to use ICT. The literature indicated that overarching factors, such as *enriching student learning* (e.g., Scott, 2015), *government policy* (e.g., Education and Health Standing Committee, 2012) and *the emergence of new technology to make learning more interesting* (e.g., Cox, Cox, & Preston, 1999) motivate teachers to plan learning experiences that incorporate the use of ICT, outside of technology-based courses such as computing and media courses. ICT was seen to *enrich student learning* by providing *motivating* (e.g., Ciampa, 2014) and *effective learning experiences* (e.g., Herrington, Reeves, & Oliver, 2010). *Government policy* related to teacher ICT practices described the importance of ICT skills for individual and national interests (e.g., Ministerial Council for Education Early Childhood Development and Youth Affairs, 2008). Further exploration of the literature revealed that *conforming to standards* was another factor motivating teachers use of ICT.

The importance of ICT capabilities was a stimulus for the development of policies requiring teachers to demonstrate proficient use of ICT to gain teacher registration (e.g., Teacher Registration Board of Western Australia, 2012). The *emergence of new technology* has provided the opportunity for students to engage in new and varied learning experiences (e.g., Wilson, 2014). Additionally, there is a need to ensure our education systems are preparing generations of digitally literate young
people for life in an increasingly digitised society (Ministerial Council for Education Early Childhood Development and Youth Affairs, 2008).

**Enriching students’ learning**

As previously mentioned, the initial exploration of the problem revealed that teachers at the research site used ICT to encourage student engagement and support learning. In meeting these ends, ICT was employed to make learning more appealing and provide students with varied learning experiences. The types of technologies and their application are listed in Table 1.1.

**Table 1.1: Application of digital technology at Heron College**

<table>
<thead>
<tr>
<th>Digital technology</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning management system (Moodle)</td>
<td>Repository for subject specific content</td>
</tr>
<tr>
<td></td>
<td>Assignment distribution and submission</td>
</tr>
<tr>
<td></td>
<td>Quizzes</td>
</tr>
<tr>
<td></td>
<td>Educational videos</td>
</tr>
<tr>
<td></td>
<td>Instant messaging</td>
</tr>
<tr>
<td></td>
<td>Discussion forums</td>
</tr>
<tr>
<td></td>
<td>Email</td>
</tr>
<tr>
<td>Interactive white boards</td>
<td>Presentations</td>
</tr>
<tr>
<td></td>
<td>Video</td>
</tr>
<tr>
<td></td>
<td>Display handwritten board notes</td>
</tr>
<tr>
<td>Audio speakers</td>
<td>Provide sound to accompany multimedia presentations</td>
</tr>
<tr>
<td>Video cameras</td>
<td>Record student presentations</td>
</tr>
<tr>
<td>Robots</td>
<td>Learn computer programming</td>
</tr>
<tr>
<td></td>
<td>Robotics competitions</td>
</tr>
<tr>
<td>Data loggers</td>
<td>Record the results of experiments for data analysis e.g. pH, motion and temperature</td>
</tr>
<tr>
<td>Laptop computers</td>
<td>Internet access</td>
</tr>
<tr>
<td></td>
<td>LMS access</td>
</tr>
<tr>
<td></td>
<td>Digital textbooks</td>
</tr>
<tr>
<td></td>
<td>Online manipulatives</td>
</tr>
<tr>
<td></td>
<td>Blogs</td>
</tr>
<tr>
<td></td>
<td>Wikis</td>
</tr>
<tr>
<td></td>
<td>Email</td>
</tr>
<tr>
<td>Desktop multimedia</td>
<td>Video editing</td>
</tr>
<tr>
<td></td>
<td>Internet research</td>
</tr>
<tr>
<td></td>
<td>Virtual manipulatives</td>
</tr>
<tr>
<td></td>
<td>Programming</td>
</tr>
<tr>
<td></td>
<td>Email</td>
</tr>
<tr>
<td></td>
<td>Accounting software</td>
</tr>
</tbody>
</table>
However, the ‘seductive’ packaging of content and the uncritical substitution of ICT for more traditional practices by teachers at the research site did not represent the most effective use of ICT to promote learning.

A review of the literature on the *seductive details* phenomena revealed that Garner, Gillingham, and White (1989) coined the term in their seminal paper to describe information that is interesting but unimportant to the main point of a text (Garner et al., 1989; Park, Flowerday, & Brünken, 2015). To date, the research on seductive details has provided mixed conclusions. Seductive details can impose an increased cognitive demand on the learner, thus taking finite cognitive resources away from developing a “coherent mental model” (Park et al., 2015, p. 268) of the content a student is learning. On the other hand, the Cognitive-Affective Theory of Learning with Media (CATLM) (Moreno, 2005, 2006) suggests that seductive details could provide motivational factors that increase the cognitive resources that individuals devote to learning.

To situate the definition of seductive details within the lexicon of learning with ICT, I proposed to extend the definition of seductive details by including the use of digital technologies (devices) that create an element of interest in the task but are unimportant to the main point of learning. Consequently, learning experiences must meet at least one of the following conditions to be classified as including seductive details. Seductive details describe the use of learning material or experiences that: (1) contain information that is interesting but immaterial to the main idea (Lehman, Schraw, McCrudden, & Hartley, 2007) or (2) use devices that are novel but unnecessary to achieve learning outcomes.

Instruction delivered via multimedia has been compared to face-to-face instruction and repeatedly found to make no significant difference to students’ learning outcomes (Kim & Reeves, 2007; Russell, 2010). Used this way, technology results in an opportunity cost for students who miss out on opportunities to engage in more productive learning experiences, such as authentic e-learning (Herrington et al., 2010). In business terms, the time teachers devote to incorporating technology into the learning environment could be described as a poor return on investment. What is more alarming is the scale at which this poor return on investment occurs.
Unfortunately, at the time of writing, the characterisation described here represents school ICT use at national and international levels. A report by the OECD (2015) that reviewed international PISA testing results concluded that in reality “our schools lags [sic] considerably behind the promise of technology” (p. 3). Many teaching practices continue to reflect the world teachers grew up in as opposed to the world their students are entering, even though educational policies have attempted to change how educators employ classroom digital technologies. One could conclude from our current situation that teachers need support to change their educational practices so that their use of ICT can better support the learning outcomes of the young people they are teaching by employing sound constructivist pedagogical practices (Churcher, 2014).

**Government policy**

The educational use of ICT has gained political attention and its presence has influenced Australia’s educational reforms (Australian Curriculum, Assessment and Reporting Authority [ACARA], 2018a; Department of Education, Employment and Workplace Relations, 2011; Hawke, 1983; Ministerial Council for Education, Early Childhood Development and Youth Affairs, 1989, 1999, 2008). Beginning in the early 1980s, Australian government policies on education have reflected the significance of ICT. The motivations for the inclusion of ICT in government policy are the educational opportunities afforded by ICT and a need to foster digital literacy in young Australians. For these two reasons, Australia’s political leaders have recognised the educational importance of technology and its role in schooling (Hawke, 1983). More recently, the Australian Curriculum (Australian Curriculum, Assessment and Reporting Authority [ACARA], 2018) has promoted ICT capabilities as being a core competency significant to Australia’s economic and social future (Ministerial Council for Education, Early Childhood Development and Youth Affairs, 2008). Subsequently, the Australian Curriculum (ACARA, 2018a) requires teachers to embed ICT capabilities into students’ learning in all curriculum areas. For example, the resources provided by Education Services Australia (2014) lists an abundance of digital resources aligned to the Australian Curriculum’s content descriptors. Even before the writing of the Australian Curriculum, the Melbourne Declaration on Educational Goals for Young Australians (MDEGYA) (Ministerial Council for Education, Early Childhood Development and Youth Affairs, 2008)
recognised that teachers were using ICT but there was a “need to increase their effectiveness significantly over the next decade” (p. 5). Currently, in Australia and elsewhere, we are in a situation where there is a disconnect between the government policies that describe how teachers should be embedding ICT capabilities into their practices and the actual capability of teachers to be able to meet these demands. As the proliferation of educational technology is fuelled by technological advances and the monetisation of education, the disconnect between teachers’ ICT capabilities and the potential of digital technology to support learning could be acute if more is not done to remedy this situation.

**Increases in digital technologies**

As each year passes, we experience a historically unprecedented level of digital connectedness and technology in our everyday lives. The presence of technology in our everyday lives extends to the digital technologies available to support both teaching and learning. For instance, it was predicted in 2013 that in the second decade of the 21st century students would have greater access to the gamification of learning and the use of learning analytics to personalise learning (Johnson et al., 2013). At the same time, Johnson et al. also predicted that in four to five years students would be going to school in wearable technologies. Five years later, wireless wearable technology is so prevalent in schools that benchmark tests of students, such as the Online Literacy and Numeracy Assessment (OLNA) and National Assessment Program – Literacy and Numeracy (NAPLAN), provide guidelines on student access to technology. The guidelines require that all students remove all wireless devices from their person before testing commences.

Today’s teachers have a responsibility to provide effective learning experiences and prepare students for their participation in a digitally enriched future. To support these ends, teachers have access to a proliferation of digital resources; many of these resources are freely available on the World Wide Web. Furthermore, contemporary society is experiencing regular digital disruption and education is not immune to these changes. Technology is changing how the business of education is conducted and the value placed on education in the face of a more automated future (Patrinos, Kattan, & Macdonald, 2017). These changes have been accompanied with new teaching strategies such as blended learning (Anthony, 2019), a form of educational
“in which a student learns at least in part through online learning, with some element of student control over time, place, path, and/or pace” (Horn & Staker, 2014, p.34). Consequently, teachers need to keep up-to-date with the latest digital technologies and digital pedagogies to best serve their students. For these reasons, teachers need to participate in ICT-related professional learning regularly.

Teachers need to participate in professional learning to ensure they can effectively use the digital technologies available to them. All Australian States and territories recognise the importance of ongoing professional learning and development. As a consequence, all Australian teacher registration bodies require teachers to participate in regular professional learning and development.

**Professional learning**

The initial exploration at the research site into the teachers’ ICT practices revealed a need to increase the effectiveness of teachers’ ICT practices. Professional learning has significant potential to improve teachers’ ICT practices. For example, in a study on Mongolian teachers, Li, Yamaguchi, Sukhbaatar and Takada (2019) found that professional learning had positive influences on six teacher-level factors: "professional competency in educational use of ICT, collaboration for ICT integration, benefits on the use of ICT, autonomy to innovate, recognition as a professional, and skills and practices in educational use of ICT" (p. 14). Furthermore, perceived professional learning and development needs are a significant teacher level variable in predicting classroom ICT use. Teachers that determine their ICT training needs as moderate to high are associated with lower levels of classroom ICT use (Moreira-Fontán, Garcia-Señorán, Conde-Rodríguez, & González, 2019, p.447). Before discussing professional learning, it is essential to make a distinction between professional learning and professional development.

The terms *professional development* and *professional learning* are sometimes used to describe two ways teachers can engage in workplace learning. *Professional development* typically refers to fixed programs that are designed to deliver expert knowledge (Timperley, 2011; Timperley, Wilson, Barrar, & Fung, 2007). Professional development, therefore, usually refers to a top-down form of learning that involves experts delivering knowledge and skills to others. On the other hand,
Professional learning represents a more context specific and ground-up form of learning (Timperley, 2011). Professional learning usually takes place within the context of a teacher’s workplace and allows teachers to take individual responsibility for their learning. Compared to professional development, professional learning usually allows teachers to have “ownership over compliance, conversation over transmission, deep understanding over enacting rules and routines, and goal-directed activity over content coverage” (Martin, Kralger, Quatroche, & Bauserman, 2014, p. 147). Unfortunately, learning through a professional development model tends to have “less impact on student outcomes than approaches that are context-specific” (Timperley, 2008b, p. 10). A professional learning approach is the type of workplace learning preferred in this research. (Note that the teachers in this study have usually referred to their learning needs as professional development needs. To prevent confusion Timperley’s (2011) term professional learning and development will be used in the thesis.) Therefore, professional learning and development experience that places learning in the context of the teachers’ work life and their school context is worthy of exploration.

The idea that learning is a cognitive process that takes place within social contexts is explained by sociocognitive theory (Bandura, 1977b), and encouraged in government publications addressing teachers’ professional learning and development, such as the Australian Charter for the Professional Learning of Teachers and School Leaders (Australian Institute for Teaching School Leadership, 2012). In a review of adult learning theories undertaken to understand school reform and teacher professional development, Smylie (1995) noted that most adult learning theories view learning as: an ongoing activity, problem orientated, a constructive process, and located in the social settings and context of the adult learner’s life. Stressing the importance of peers in the workplace, a study conducted by the UK Department for Education and Skills found that 90% of teachers reported that their principal source of professional advice and training was their work colleagues (MacDonald, 2008). In Australia, the Ministerial Council for Education, Employment Training and Youth Affairs (2005) produced a report on pedagogical strategies for using ICT. The report recommended that “[t]eachers learn to use technologies most effectively in the context of their own work and the pursuit of their professional needs” (p. 10). Therefore, it would be prudent to combine the learning needs of teachers with the peer-supported learning
practices that are already occurring in the schools. One way this synergy can occur is by nurturing teachers’ engagement in a community of practice.

When participating in communities of practice, participants come together to form a social learning system that, according to Barab, MaKinster, and Scheckler (2003), is a “persistent, sustained social network of individuals who share and develop an overlapping knowledge base, set of beliefs, values, history, and experiences focused on a common practice” (p. 238). Through participating in a community of practice, members seek new ideas, strategies, and practices that help others reconceptualise their present understanding of practice. Moreover, the intellectual stimulation provided by participating in a community of practice could encourage the transformational practices of teachers’ digital learning media use (Vermeulen, Kreijns, van Buuren, & Van Acker, 2017).

The term community of practice ultimately describes learning that occurs through social participation. Wenger, McDermott, and Snyder (2002) defined a community of practice as “groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis” (p. 7). Having the potential to address limitations that exist with professional development, the community of practice model was selected as an intervention strategy to support professional learning and development in this research. The benefits of participating in a community of practice include:

- knowledge sharing among colleagues (Stein, Smith, & Silver, 1999);
- opportunities for professional learning and development that extend over a substantial length of time (Bonk, Ehman, Hixon, & Yamagata-Lynch, 2002; Li et al., 2019)
- learning that is contextually related to the participants’ work lives (Bradshaw, 2002); and
- engagement that provides the opportunity for the participants to co-construct collective efficacy beliefs (Lucas, 2003).

**Collective efficacy**

Collective efficacy was defined by Bandura (1977a) as future-orientated cognitions about “a group’s shared belief in its conjoint capabilities to organize and execute the
courses of action required to produce given levels of attainments” (p. 447). It is the relationships among high levels of collective efficacy, the greater likelihood of implementing innovative teaching strategies, and engaging in professional learning and development that are significant to this research.

Collective efficacy describes estimations of capability at the group level. Thus, teacher collaboration has the potential to impact collective efficacy beliefs positively. The correlation between collaboration and collective efficacy was demonstrated in the study conducted by Y. Goddard and Kim (2018), which explored the impact of teacher collaboration on differentiated instruction practices. Their study identified a positive correlation between teacher collaboration, the use of differentiated instructional practices and teacher efficacy beliefs. This qualitative study identified a significant correlation between the variables they were studying; however, it did not identify causality. Nevertheless, efficacy is a construct derived from social cognitive theory (Bandura, 1986), as is the theory of reciprocal determinism, which would predict that the causality was bidirectional between the variables studied.

Based on my early observations, I made the prediction that to significantly raise the ICT capabilities of the teachers participating in this study, it would be necessary for teachers to develop a belief in their ability to raise ICT capabilities (efficacious beliefs). Furthermore, a rise in ICT capabilities and efficacious beliefs would be best achieved through an ongoing collaborative approach to learning (community of practice).

**Purpose of the study**

This research project was conducted with the aim of contributing to both the theory and the practice related to teacher professional learning and development. To achieve these aims, the research was designed to support a group of teachers to enhance their ICT capabilities through a focus on enhancing the teachers’ co-constructed collective efficacy beliefs for using ICT through their participation in a community of practice. In meeting these ends, the research aimed to investigate the contextual factors that support teachers’ participation in the community of practice as well as investigating the factors influencing the co-construction of collective efficacy beliefs. The
community of practice aims to provide a practical and convenient solution for teachers in this study.

Phase 1 of the design-based research approach seeks to identify a problem and then identify a solution to the problem that can be tested and refined. This is different from other research approaches that begin with a solution to test and evaluate, as the design-based research approach begins by identifying a significant problem. Over the course of a few years, I had observed teachers at the research site make limited use of or disregard the range of digital resources available to them. With a requirement for Australian teachers to develop student’s ICT capabilities (Australian Curriculum, Assessment and Reporting Authority [ACARA], 2018b) and dismissal of technology-enhanced learning (Gordon, 2014) opportunities, the situation at the research site represented a “significant educational problem” (Herrington et al., 2010, p. 177). Now a significant educational problem had been identified, further exploration was required to understand and contextualise the problem. The initial lines of research occurred through a range of non-intrusive methods at the research site. These methods included onsite discussions with teachers, observations of group discussions, reviews of internal communications (such newsletters and emails) and an exploration of the Principal’s survey regarding the College’s strategic plan. This consultation provided insight into the extent of the problem and answered questions such as: Who knew about the problem? What data should be collected from the practitioners? What questions should be asked during the next round of data collection? And an insight into how the data should be analysed (Herrington et al., 2010). During the initial consultation with the practitioners, the teachers revealed that they experienced:

- a lack of time to engage in activities supporting ICT implementation;
- a variety of hardware and capability challenges when required to use their school’s digital technologies;
- feelings of frustration when dealing with the technology they considered to be restricting their classroom pedagogy; and
- a perceived need to participate in technology-focused professional development activities.
After the practitioners’ experiences had been analysed, the literature was consulted to explore what was already understood about the problem and “how similar problems might have been addressed” (Herrington et al., 2010, p. 179) (the literature review is presented in Chapter 2). Through the work completed during Phase 1, there was “a clear description of the problem and its educational context, a literature review, a summary analysis of practitioners views, and preliminary research questions” (Herrington et al., 2010, p. 179).

By the end of Phase 1, it was evident that this study was going to be conducted with the pragmatic purpose of making practical as well as theoretical contributions to the literature. In this way, the research:

- investigated and explained how a community of practice framework influenced teachers’ co-construction of collective efficacy beliefs about ICT use;
- investigated and explained how school context influenced teachers’ co-construction of collective efficacy beliefs for using ICT; and
- created a set of design principles to support others who wish to use communities of practice to nurture teachers’ ICT capabilities.

The theorised outcome of improving teachers’ ICT capacities is that teachers will have access to a wider range of digital skills and pedagogies to enhance the engagement and learning of their students. Also, the teachers will be better able to support the development of students’ digital literacy.

**Research question**

The research question guiding this inquiry is:

In what ways can a professional learning framework, based on the principles of communities of practice, support the co-construction of collective efficacy beliefs and transform individual teaching practices in the implementation of information and communication technology?
The research question guided an exploration into how teachers’ participation in a community of practice to enhance their ICT practices was influenced by contextual factors and the role of collective efficacy beliefs in the teachers’ learning trajectories.

The significance of the research

This research was driven by the need for teachers to become competent users of digital technologies and to assist them to develop pedagogical strategies that supported students’ learning with digital technologies. Digitally competent teachers can better support the learning needs of their students and prepare students for their future participation in a knowledge economy. In Western Australia there are policies in place that require teachers to embrace digital technologies in their teaching practices; nevertheless, teachers need assistance to live up to the expectations of these policies in the form of professional learning and development. Moreover, much remains unknown about the factors that affect teacher collective efficacy in schools. This research contributes to an understanding of how contextual factors influence teachers’ participation in professional development and learning activities, contributes to the scholarship on collective efficacy theory, and provides a set of design principles that can be used by schools seeking to enhance the ICT capabilities and collective efficacy of their teachers.

Research design

This research utilised a design-based research approach to address the problem of teacher ICT capability. Within this approach, a case study methodology was employed to: explore this complex phenomenon in situ, aid the development of theory, and refine the resulting design principles. A design-based research approach is a pragmatic approach that supports the development of educational innovations while also supporting emergent theories. This research approach has been described by Barab and Squire (2004) as being focused on “understanding the messiness of real-world practice, with context being a core part of the story and not an extraneous variable to be trivialized” (p. 3). The design-based research approach begins with a practical problem for which an intervention is created to address the problem. The intervention is then tested and refined through iterative cycles and culminates in a set of design principles that can be used by others to address the original problem. To analyse the data collected in this study, an embedded case study methodology (Yin,
was employed. The sub-units emerge from employing the constant comparative method (Glaser, 1965).

The organisation of the thesis

The organisation of this thesis is as follows. Chapter 1 introduces the background to this study. Chapter 2 reviews the literature on communities of practice and collective efficacy beliefs. Following the discussion of these two constructs, a conceptual model is presented that conveys how collective efficacy beliefs are supported as teachers engage in a community of practice. Chapter 3 describes the methodology used during this study, including an overview of the design-based research approach. The third chapter also introduces the research site and teachers who participated in this study. In Chapter 4, the design of the learning environment is outlined as are the draft design principles that guided the intervention delivered at the research site. The data analysis begins with Chapter 5. In this chapter, the influence of the classroom context is explored. With a focus on the broader contexts of a teacher’s work, Chapter 6 describes the influence of school leadership. Reflecting on the data analysis and relevant literature, the final design principles are presented, and the conclusion and implications are described in Chapter 7.
Chapter 2: Literature Review

Chapter 2 contains a review of the literature related to teacher collective efficacy beliefs, communities of practice, and contexts influencing teachers’ ICT practices. Firstly, the community of practice literature is reviewed with a focus on how communities of practice can positively contribute to the co-construction of collective efficacy beliefs. Next, the chapter provides an overview of two relevant social perspectives on learning and how collective efficacy emerged from research on self- and teacher efficacy beliefs and its relationship to organisational agency. This is followed by a discussion of the contextual factors influencing teachers’ ICT practices. Finally, a conceptual framework is presented to support a community of practice approach to facilitate professional learning and development that also enhances the co-construction of collective teacher efficacy beliefs for ICT capability.

**Perspectives on learning**

Identifying both the importance of enhancing teachers’ ICT capabilities and the significance of supporting the co-construction of collective efficacy beliefs when attempting to enhance teachers’ ICT capabilities lead to questions about how these capabilities and beliefs are developed and the role schools can play in this improvement. Cognitive psychology explains how beliefs and capabilities are acquired and modified (Schunk, 2012) through the lens of learning theory frameworks. Two learning theories that can provide an explanation of the relationship between the social world and cognitive development are the sociocognitive (Bandura, 1977b, 1986, 1997) and sociocultural (Lave, 1991; Lave & Wenger, 1991; Vygotsky, 1978) frameworks. The sociocultural learning framework postulates that knowledge emerges through negotiated meaning and social identification (Fischer, Rohde, & Wulf, 2007). The sociocognitive perspective focuses on the individual and emphasises reciprocal determinism among behavioural factors, personal factors, and environmental influences. Within this triadic reciprocity, learning occurs through personal and vicarious experiences (Bandura, 1997). The main distinction between these two frameworks is that the sociocognitive
perspective locates individual cognitive processes as the central mechanism of learning, whereas the sociocultural perspective positions social practices as the central mechanism of learning. As Chapter 1 has already argued in favour of professional learning over professional development, the following section furthers this line of discussion by describing the community of practice model of learning.

**Communities of practice**

An interest in communities began far before the French philosopher Auguste Compte (Turner, Beeghley, & Powers, 2011) popularised the term *sociology*. There is evidence communities have been a focus of academic scholarship as far back as Plato and his interest in the foundations of a utopic community (Jowett, 1873). One of the first known large-scale efforts to gather community data was the compilation of the Doomsday book in 1086 (Williams & Martin, 2003). The term *community* originates from the Latin term *communitatus*. Its components mean *com*, together, *munis*, a Proto-Indo-European element meaning changes or exchanges, and *tatus*, implying small or local. Consequently, a community differentiates itself from the greater society, as it is a group of people inhabiting a space within the larger society and who are involved in various forms of exchange.

While researching situated learning, Lave and Wenger (1991) coined the term communities of practice to describe learning that occurs through social participation. The emphasis on social participation is apparent in the various definitions of a community of practice. For example, Wenger et al. (2002) described communities of practice as “a group of people who interact, learn together, build relationships, and in the process develop a sense of belonging and mutual commitment” (p. 34). Similarly, Barab and Duffy (2000) described a community of practice as “a persistent, sustained social network of individuals who share and develop an overlapping knowledge base, set of beliefs, values, history and experiences focused on a common practice” (p. 41). Both definitions emphasise that communities of practice not only focus on the knowledge that is shared or learnt through participation but also consider the interactions, which influence how members align their identities with the communities of practices in which they participate. The community of practice construct was derived from the theory of situated learning (Lave & Wenger, 1991), also known as situated cognition (Brown, Collins & Duguid, 1989). The
characteristics of communities of practice are important for the design of the intervention described in this thesis; consequently, an in-depth examination of these characteristics is provided in the following section.

The community of practice perspective rationalises that individuals negotiate meaning through interpreting and contributing to events from their everyday lived experiences through the contemporaneous processes of participation and reification (Wenger, 1998). Participation refers to the act of engaging in an event, whereas reification refers to the process of ascribing meaning to an abstract concept in material or imagined ways.

As learning is more than just the transfer of knowledge, communities of practice theory also considers the personal and social factors that influence learning. For instance, through participation in a community of practice, when knowledge is created, it is “historically and socially defined” (Wenger, 2000, p. 226) by the participants. Furthermore, as individuals share experiences within their community of practice, they expand and define the boundaries of what the community values as knowledge. Consequently, when individuals experience a disparity between their practices and socially defined competencies, an opportunity for learning can occur. This framework of learning suggests that learning occurs through the interplay of an individual’s personal experience and socially defined competencies. Furthermore, members can gain knowledge as well as influence what the community regards as meaningful knowledge.

For a social learning system to fit the requirements of a community of practice, it needs to exhibit the following three characteristics: domain, community and practice:

- The community has an identity based upon a communal domain of interest. Membership to a community of practice denotes dedication to a domain and a shared competence that distinguishes them from other groups of people (Wenger, 1998).
- Community represents the membership and the relations amongst a community’s members that were created through their mutual engagement in a joint enterprise and shared repertoire (Wenger, 1998).
Members of a community share and develop practices as they pursue their curiosity in a domain of interest. These practices can include frameworks, stories, methods and tools (Wenger, 2000). It is the strength of these three characteristics that can influence the effectiveness of each community of practice to support the development and sharing of meaning.

As the teachers in this study engage with the community of practice, they move through a trajectory of learning. This means, teachers join a community of practice with existing levels of ICT capabilities and, through their engagement in community activities, they share, learn and develop practices that they did not have when they first joined the community of practice. As the teachers in this study participate in the activities belonging to their community of practice, their learning trajectory will influence their identity as a teacher. To help understand the phenomena of meaning and identity formation, Wenger (1998) has identified three modes of belonging: engagement, imagination and alignment:

- **Engagement** is the continuous negotiation of meaning, the genesis of trajectories and the interpretation of historical practices. The mutual engagement of community members can create a socially defined reality to participate and derive identity.
- **Imagination** is another way to derive meaning. Through producing images, ideas and sensations in the mind we can create mental images of our world and ourselves that transcend time and space.
- **Alignment** is the “coordination of energies, actions and practices” (Wenger, 1998, p. 179) that are congruent with the community’s domain of interest and contribute to community enterprises.

In addition to the modes of belonging, Wenger (1998) identified four binary dualities that can enact and sustain engagement in a community of practice. Wenger uses the term dualities to emphasise the creative tension between opposing forces that are drivers of learning. These dualities of participation exist along four dimensions:

- **Meaning** – participation and reification
- **Time** – designed and emergent
- **Space** – local and global
- **Power** – identification and negotiability (p. 232).
The significance of these dualities is that they provide a rich description of how communities of practice work and bring attention to the attributes where interventions can be designed.

The modes of belonging and the dualities of participation have been synthesised into an educational design that Wenger (1998) has labelled the “learning architecture”. The utility of Wenger’s learning architecture is that it provides an opportunity to predict how the modes of belonging and the dualities of participation might transpire in a learning environment. A summary of the components and dimensions of Wenger’s (1998) learning architecture are presented in Table 2.1. For this study the most important dimensions are participation and reification, which represent taking part in a community of practice and turning ideas into being. In addition, identification and negotiability, which represent belonging to the community coupled with it becoming part of a person’s identity and the ability to contribute, take responsibility and shape meaning (Wenger, 1998). More recent research, based on the seminal works described above, has identified additional benefits to participating in communities of practice.

In a review of the community of practice literature from 2012 to 2017, Ripley (2017) evaluated 45 studies that described Lave and Wenger’s community of practice framework in an educational context and reported on teachers “experience of participating in the community of practice” (p. 36). From this review, Ripley identified five broad themes emerging from the 45 studies reviewed:

- **Collaboration** – The community of practice framework provided opportunities for teachers to collaborate (e.g., DeMeulenaere, 2015; Marsh, 2013), which otherwise may not have occurred without the formation of a community of practice.

- **Reflection** – the domain of learning championed by a community of practice encouraged teachers to reflect on their existing teaching practices (Woodgate-Jones, 2012). Reflection occurred largely through the teachers’ ‘participatory’ role in learning (Green, Hibbins, Houghton, & Ruutz, 2013).
• **Student learning** – the professional learning and development that results from teachers’ participation in a community of practice resulted in improved student learning outcomes (Goodnough, 2010; Marsh, 2013; Tam, Chan, Li, & Pow, 2018).

• **Motivation for professional growth** – the experience of participating in a community of practice can promote a desire for professional growth in teachers (Goodnough, 2010; Hadar & Brody, 2013; Marsh, 2013).

• **Ownership of learning** – the opportunity to be a self-directed learner provided teachers with a sense of ownership of their learning (Goodnough, 2010; Mellony, 2004).

Asides from the benefits listed above, engagement in a community of practice can result in challenges for teachers.

Mak and Pun (2015) examined how the communities of practice framework could be cultivated and sustained to support a professional learning and development writing project for 18 English as a Second Language teachers in Hong Kong. In this study, Mak and Pun identified school and personal demands as being a challenge to sustaining their community of practice. Furthermore, they emphasised the important support roles that colleagues, school leaders, parents and the school community play in sustaining a community of practice. In another study from Hong Kong, Tam, Chan, Li and Pow (2018) examined the influence of social, intellectual and organisational capitals on the implementation of an e-learning initiative at a primary school. This study echoed the importance of supportive colleagues, school leaders, and parents in the success of professional learning communities. Yet, the literature reviewed for this study payed scant attention to the role of these school and community level factors.

Earlier in this chapter, it was identified that learning not only included the construction of meaning but it also involved the construction of beliefs. Consequently, as teachers co-construct meaning surrounding their ICT practices, they will also co-construct beliefs through the processes of participation and
reification because identity is intrinsically linked to the negotiation of meaning. Wenger (1998) has affirmed:

Identity in practice is defined socially not merely because it is reified in social discourse of the self and of social categories, but also because it is produced in lived experience of participation in specific communities. What narratives, categories, roles, and positions come to mean as an experience of participation is something that must be worked out in practice. An identity, then, is a layering of events of participation and reification by which our experience and its social interpretation inform each other (p. 151).

To incorporate beliefs more fully within the community of practice framework, the concept of collective efficacy is used to connect teachers’ learning in the community and their practice. Therefore, the community of practice framework can support an intervention to enhance teachers’ efficacy beliefs.

**Development of collective efficacy**

In schools, collective efficacy in an important organisational property. Collective efficacy helps mobilise teachers’ social capital and effectiveness due to the positive impact it has on teacher efficacy beliefs (Goddard & Goddard, 2001) and student achievement (Bandura, 1997). In 2016, Hattie described collective teacher efficacy as having the largest effect size (1.57) on students’ achievement. Although the major significance of collective efficacy for schools is quite recent, collective efficacy is not a new construct.

Collective efficacy evolved from the earlier, more individually focused, research on self-efficacy beliefs (Bandura, 1977a, 1986, 1997) and teacher efficacy beliefs. Self- and collective efficacy beliefs are based on Bandura’s (1977a) social cognitive theory. The social cognitive theory explains the reciprocally deterministic relationship that exists between personal, environmental and behavioural factors, and focuses on behaviour change. It views individuals as central to human learning and development, and adheres to the theory that learning occurs in social contexts mainly through observation.
As the research direction began to explore efficacious beliefs at an organisational level, collective efficacy became recognised as a construct in its own right. Due to similarities between the two constructs, the primary sources of efficacy information that influence self-efficacy can also be applied at an organisational level and be shown to influence collective efficacy beliefs. The similarity between these two constructs is in no small part due to the fact that “beliefs of personal efficacy are not detached from the larger social system in which members function” (Bandura, 1997, p. 478). Furthermore, the closeness of these constructs means that collective efficacy beliefs can to a degree influence an individual’s self-efficacy beliefs. Due to the interlaced relationship of these two constructs, it would be challenging to present a coherent description of collective efficacy without including a discussion of self-efficacy beliefs. Therefore, the following section begins with an introduction to self-efficacy beliefs before presenting a review of collective efficacy beliefs.

Self-efficacy beliefs

More than one definition has been used to describe self-efficacy beliefs. Bandura (1977a), has described self-efficacy as the “belief in one’s capabilities to organise and execute the courses of action required to produce given attainments” (p. 3). More recently, Dellinger, Bobbett, Olivier, and Ellett (2008) define self-efficacy beliefs more specifically related to the work of teachers as “individual beliefs in their capabilities to perform specific teaching tasks at a specified level of quality in a specified situation” (p. 752). The strength of an individual’s efficacy beliefs relates to the likelihood that they will engage in an action. For example, if a teacher does not believe that they have the capabilities required to use ICT in the classroom, the teacher will “have little incentive to act” (Bandura, 1997, p. 1). Self-efficacy beliefs are future orientated cognitions that are influenced by mastery experience, vicarious experience, social persuasion and psychological factors (Bandura, 1997). These four factors are described in the following sections.

Mastery experience

According to Bandura’s (1997) theory of self-efficacy beliefs, enactive mastery experiences have the potential to be the most substantial influence on a teacher’s efficacy beliefs. Therefore, teachers who regularly use ICT in their teaching will be positively enhancing their beliefs about their capacity to use ICT. Conversely,
teachers who are not regularly using ICT may not be enhancing their efficacy beliefs for using ICT. As efficacy beliefs are very task-specific, the most influential mastery experiences will be the mastery experiences gained during the act of teaching (Tschannen-Moran, Hoy, & Hoy, 1998). However, schools present many obstacles that prevent teachers from engaging in mastery learning, such as a lack of resources (Tschannen-Moran & Hoy, 2007), time constraints (Ross & Mason, 2001), and student distractions (behaviours) (Mulholland & Wallace, 2001). These obstacles can all negatively impact a teacher’s ability to engage in enactive mastery. One way of overcoming these limitations is for teachers to participate in activities outside of the classroom, such as engaging in professional development opportunities (Murphy, Neil, & Beggs, 2007) and seeking out opportunities to engage in cognitive mastery. However, there are opposing views on this idea.

Palmer (2011) suggested that cognitive mastery experiences, a form of mastery experience, can be enacted by teachers when they develop new pedagogical and content knowledge during professional development. On the other hand, Tschannen-Moran, Hoy, and Hoy’s (1998) believe that mastery learning can only occur in situ, and this is the view that is more aligned with the professional learning and development approach in this study. The intervention implemented in this research sought to promote mastery learning through implementing practices teachers learn about through their engagement in a community of practice.

**Vicarious experience**

Teachers work in school communities; they do not work in isolation. Consequently, teachers have opportunities to learn through observing the practices of their peers. During these encounters, a teacher’s efficacious beliefs can be influenced by the actions of their peers. The degree to which a teacher experiences vicarious learning is dependent on the extent to which they can identify with their peers (Bandura, 1997). The closer a teacher identifies with their peers, the greater the opportunity there is to influence efficacious beliefs. Consequently, if a teacher observed a close peer using digital technology, the observer’s efficacy beliefs for using ICT could be positively influenced. This is a case of, if you can do it, I can do it too. On the other hand, if a teacher observes a peer struggling with digital technology, ineffectual beliefs may be formed.
Even though working in schools provides teachers with opportunities to experience vicarious learning, in general teachers rarely participate in peer-to-peer observations (Mulholland & Wallace, 2001). Furthermore, a lack of relative expertise in the use of digital technologies could mean that this form of learning is not widely available in schools. Nevertheless, if time and expertise are available vicarious learning can be experienced through professional learning and development activities.

**Social persuasion**

Social persuasion represents social influence that an individual can experience from others (Bandura, 1997). For example, persuasive messages of encouragement can support and bolster a teacher’s efficacious beliefs. Through teachers’ social networks, verbal persuasion could be conveyed (Siciliano, 2016) by school leaders, teachers, trainers, students and the wider community. Many of these persuasive messages will be received in the form of verbal or written communication. Although collective efficacy can be developed through the encouragement of others, it is a weaker source of efficacy information (Berebitsky & Salloum, 2017) than some of the others described in this section.

**Psychological factors**

Self-efficacy beliefs are influenced by the emotions people experience as they respond to situations. When teachers use ICT, it can create positive emotions like pleasure and excitement. The experiencing of positive emotions can enhance efficacious beliefs. However, if using ICT creates negative emotions, such as nausea and fear, efficacious beliefs can be negatively influenced.

Bandura (1997) has suggested that the four sources of efficacy do not exert an equal level of influence. He described the most potent form of efficacy information as mastery experiences. Nevertheless, Bandura’s categories are not as mutually exclusive or universally applicable as they may first appear. For example, a teacher participating in peer observation may simultaneously experience vicarious and affective learning. For a researcher, it would present a great challenge to quantify the amount of influence each source exerts from each unique and subjective experience. It may be prudent to suggest that these categories may be more interdependent, and that career stage and context will make a difference to how the sources of efficacy
information are received. In addition to these differences, the passage of time can modify efficacy information.

When considering the sources of efficacy information, Bandura (1997) identified four different changes that can occur to efficacy beliefs: acquisition, generality, durability and resilience:

- acquisition – represents the development of efficacious beliefs,
- generality – a mental model that represents the limits of efficacious judgements,
- durability – the robustness of efficacy beliefs over time, and
- resilience – a resistance to the changing of one’s efficacy beliefs.

The four changes to efficacy beliefs that Bandura (1997) identified have some similarities to Wenger’s (1998) dualisms as both describe activities that drive learning. Each theory includes the construction of meaning, both describe the limits imposed by generality and both include the influence of time on outcomes of learning. Where they differ is in the dimensions of power and resilience.

Interestingly, Watson (2006) performed a long-term study on the effects of a five-day professional development course followed by an online learning component. Watson found that the increase in self-efficacy beliefs that resulted from participating in the five-day professional development remained at the same level when assessed years after the teachers had completed the course. The study also concluded that further engagement in professional development over time did not have a significant effect on the efficacy of teachers at a personal level. However, there was no comment on how this influences the collective efficacy of teachers. If the increases in teachers’ efficacy can be maintained over time, a long-term intervention aimed at increasing teachers’ efficacious beliefs could be well worth the efforts. Over time, research on self-efficacy beliefs was soon followed by research into the efficacy beliefs developed at the group level – collective efficacy.

**Collective efficacy**

Schools require the coordinated efforts of teachers working together as a community. Therefore, it was a natural progression that efficacy research was eventually applied to groups of individuals and used to describe and predict group-level efficacy beliefs.
Bandura (1997) defined collective efficacy beliefs as a “group’s shared belief in its conjoint capabilities to organise and execute courses of action required to produce given levels of attainments” (p. 477). Therefore, teachers’ collective efficacy beliefs are an emergent, group-level attribute (Bandura, 1997, 2001) that is predicted to influence organisational agency (Hoy, Sweetland, & Smith, 2002). Although collective efficacy beliefs and self-efficacy beliefs are related constructs, collective efficacy is a unique construct in its own right. Yet, there can exist a reciprocal relationship between self- and collective efficacy beliefs. For example, self-efficacy beliefs are influenced by the collective efficacy of a group because “individuals inevitably consider group processes that enhance or hinder their efforts” (Bandura, 1997, p. 478). Later, Goddard, Hoy, and Hoy (2000) extended Bandura’s (1997) model of collective efficacy beliefs to create a conceptual framework that included two additional sources of information – namely, task analysis and assessment of competence – that inform collective efficacy judgments. The following sections describe the sources and effects of collective efficacy beliefs.

Teachers’ beliefs about their collective capacity are influenced by mastery experience, vicarious experiences, social persuasion and affective states. The mechanism by which these factors influence collective efficacy is analogous to those that influence self-efficacy. In support of this view, Bandura (1997) stated that “perceived personal and collective efficacy differs in the unit of agency. However, in both forms, efficacy beliefs have similar sources, serve similar functions, and operate through similar processes” (p. 478), yet their influence on collective efficacy beliefs is not as powerful. The difference is due to the presence of additional variables that individuals considered when forming collective efficacy beliefs. Bandura (1997) described the additional influences as knowledge and competencies in the group, how the group is structured and its activities coordinated, how well it is led, the strategies it adopts, and whether members interact together in mutually facilitating or undermining ways. These variables are so numerous and diverse that they can impact upon enactive mastery, vicarious experiences, verbal persuasion and psychological factors.
In their model describing the formation and influence of collective efficacy in schools, Goddard et al. (2000) suggested that when teachers form efficacy judgments about their colleagues’ collective ability to organise and execute actions, they need to evaluate the task’s properties and the context within which the task will be enacted (task analysis), and make judgments about the group’s capabilities, including their strengths and weaknesses (assessment of competence). Once the teacher has evaluated the complexity of the task and considered the context in which the task will be carried out, the teacher can weigh this information against the available resources and the capabilities of the group (Goddard et al., 2000; Goddard, Hoy, & Woolfolk Hoy, 2004). Therefore, a positive belief about a group’s collective efficacy to achieve a goal will be formed if the context, resources and group’s competencies are perceived as being adequate for the task. Conversely, through the same mechanisms, a low estimate of collective efficacy beliefs can also be formed.

High levels of collective efficacy beliefs have benefits that extend to both students and teachers. For students, high levels of collective teacher efficacy beliefs have been positively associated with student achievement (Bandura, 1993, 1997; Goddard et al., 2000) and also correlate with high levels of student motivation (Goddard & Goddard, 2001). For teachers, high levels of collective efficacy beliefs may assist teachers in coping with work-related stress and an increased sense of job satisfaction (Klassen, Usher, & Bong, 2010). Furthermore, collective efficacy beliefs have been found to “lead teachers to be more persistent in their teaching efforts, set high and reasonable goals, and overcome temporary setbacks and failures” (Hoy et al., 2002, p. 90).

As well as identifying positive correlations to the work of teachers, collective efficacy beliefs have also been used to predict group levels of performance (Bandura, 1993, 1997; Myers, Feltz, & Short, 2004). When working on challenging tasks, collective efficacy beliefs influence the flow of a group’s activity. In a study on tertiary students participating in the organisation of cultural experiences at their university campus, Salanova, Rodríguez-Sánchez, Schaufeli, and Cifre (2014) found that there existed a strong positive relationship between the group’s collective efficacy beliefs and their collective flow. Furthermore, it was discovered that a reciprocal relationship between collective flow and collective efficacy beliefs...
occurred over time. From the sociocognitive perspective, Bandura’s (1997) concept of collective efficacy can be used as a lens to predict how teachers with higher collective efficacy beliefs are more likely to: persist with underachieving students, implement innovative teaching strategies, participate in professional development, and support student-centred learning over teacher-centred instructional practices.

It has been established that teachers can enhance their ICT capabilities and co-construct collective efficacy beliefs through their engagement in a community of practice. The community of practice framework is derived from the sociocultural, situated learning perspective (Lave, 1991), and will provide part of the context from which teachers will learn, transfer learning and co-construct collective efficacy.

Although similar in many ways, the two learning theories differ in their interpretations of the terms contexts and learning transfer, which may arise in different interpretations of this research. The similarities between Bandura’s (2001) social cognitive theory and Lave and Wenger’s (1991) situated learning perspective are broad. Both learning theories consider that learning:

- transpires in the real-world,
- occurs as the result of human interaction, and
- can be supported through modelling and mentorship from others.

From the standpoint of social cognitive theory, contexts are considered to exist independently of the individual. On the other hand, the situated learning perspective explains context is “defined in terms of participation in a social context” (Cobb & Bowers, 1999, p. 5). Although very similar, the two learning theories differ in their treatment of the concept of learning transfer. Social cognitive theory considers learning as largely the result of observing others and applying this learning to other situations. Whereas, situated learning follows that learning that takes place in authentic contexts is more likely to be transferred than learning that does not take place in an authentic context. To reconcile the differences in the interpretation of context and learning transfer, all references to context and learning transfer hereon in shall be from the situated learning perspective, which is represented in the overarching framework described in the next section.
Collective efficacy is an essential factor to consider when understanding how teachers can collectively improve their ICT practices, for the simple reason that people tend to place more effort into activities they believe they can complete and avoid the activities they believe they will not be able to accomplish. Furthermore, the inclusion of collective efficacy addresses the issue of motivation being an underdeveloped concept in Wenger’s communities of practice framework (Abou-Setta, 2015). To these ends, teachers’ ICT practices are influenced by the attitudes and actions of their peers, the challenge of a task, and the estimation of their abilities.

**Guiding conceptual framework**

Informed by the reviewed literature, a conceptual framework was developed for this study. The framework was created with the aim of combining collective efficacy theory with the community of practice theory. The resulting conceptual framework is presented in Figure 2.1. The conceptual framework presented below was influenced by Wenger’s (2010) learning architecture and Goddard, Hoy, and Hoy’s (2000, 2004) model of teacher collective efficacy.

![Figure 2.1: Guiding conceptual framework](image)

The community of practice learning architecture is presented as the second largest element of the conceptual framework. It is within the learning architecture that the design-based interventions will be enacted. The interventions will aim to influence the source of teachers’ collective efficacy beliefs through the teachers’ modes of belonging. The large arrow on Figure 2.1 indicates this interaction. Once new sources of efficacy have been experienced, appraisals of these experiences will create
collective efficacy beliefs. The proposed research aimed to explore how new collective efficacy beliefs influenced the development of ICT capabilities. Furthermore, the framework illustrates how feedback about the teachers’ ICT implementation can be a source of efficacy influence, thereby influencing future appraisals.

Gaps in the literature

MacDonald (2008) made the observation that many studies have researched how ICT can support communities of practice, such as the studies by Hung, Chee, Hedberg, and Seng (2005) and Kirschner and Lai (2007); however, fewer studies have examined the contextual influences on the community of practice participation. Adams and Forsyth (2006), in their discussion of self-efficacy beliefs, described a gap in the literature addressing the role of context in current models of self-efficacy belief development. Furthermore, Takahashi (2011) supported Wenger’s (1998) proposition that there is a lack of attention to the “role of implicit negotiations of meaning” (p. 735), that could be limiting an understanding of how efficacy beliefs develop. Therefore, a better understanding of how these beliefs develop could help policymakers and educational leaders nurture collective efficacy beliefs.

Researchers have found collective efficacy to be a useful construct to measure and influence teachers’ beliefs about capability; however, there remain gaps in the literature that need attending to. To date, most of the research on teacher efficacy beliefs have focused on construct validity and correlations between teachers’ self- and collective efficacy beliefs, student learning, and teacher professional behaviours (Klassen, Tze, Betts, & Gordon, 2011). In their review of teacher efficacy and collective efficacy, Klassen, Tze, Betts, and Gordon (2011) compared 218 peer-reviewed articles published between 1998 and 2009 with efficacy research published between 1986 and 1997. One of the gaps in the literature they identified was that the existing body of research on efficacy beliefs lacked relevance to practice. Although many studies have described a correlation between efficacy constructs and student achievement the research did not provide much guidance on practical solutions addressing issues related to teacher practice (Tschannen-Moran & McMaster, 2009). This gap is still an issue today, and this research contributes to addressing this gap. In addition to the factors influenced by collective efficacy, communities of practices
have also been demonstrated to enhance teachers’ ICT practices. The literature reviewed in this chapter indicates that providing ongoing professional learning and development in the form of a community of practice would enhance the ICT capabilities of teachers.

After the initial exploration of the problem with the practitioners and a review of the literature on professional learning and development, the community of practice framework, and the teachers’ sense of efficacy, the literature revealed further evidence-based approaches to inform the design of the intervention. These approaches were related to: the trajectory of the teachers’ learning (Australian Institute for Teaching and School Leadership, 2011), human agency beliefs (Bandura, 2008), and the ineffectiveness of professional development (Timperley, 2011). Furthermore, the literature confirmed that novice ICT practices were widespread amongst teachers. For example, a UNESCO case study on ICT training described Australia as having “a whole generation of teachers who are not only struggling with basic personal digital literacy but also, and more importantly, ICT pedagogy integration” (Lloyd, Downes, & Romeo, 2016, p. 39). This assessment of Australian teachers confirms past assertions that teachers need support to progress through a learning continuum from novice to expert practitioners (Schibeci et al., 2008). Bandura’s (Bandura, 1977a, 1997) self- and collective efficacy theories predict that an intervention aimed to improve ICT capabilities would require teachers to hold belief in their ability before they would attempt to further develop their ICT teaching practices willingly. Fortunately, the teachers consulted during Phase 1 of this study expressed a need and desire for professional development; however, professional development activities such as seminars, lectures and workshops are usually insufficient on their own to facilitate mastery of the information presented during these sessions (Becta, 2009).

An effective way to increase teachers’ ICT capabilities is to support them with professional learning and development experiences (Timperley, 2011). The significance of professional learning and development experiences to support ICT practices was acknowledged in a report by the Western Australian Department of Education and Training: Evaluation and Accountability Directorate (2006). In their report into the level of ICT “knowledge and skill levels among Western Australian
(WA) government school teachers” (p. 5) they found that “improving the ICT competence levels of teachers will increase teacher integration of ICT within the classroom” (p. 47). The report also found that “teacher attendance at training on how to integrate ICT in the classroom had the most positive impact on a teacher’s level of ICT integration” (p. 47). Thus, it is essential that interventions provide a learning environment where teachers are supported to enhance their ICT capabilities.

**Potential design principles**

The inquiry conducted during Phase 1 provided essential considerations for the design of an intervention. The consultation with the practitioners revealed that time limitations, challenges with ICT integration, and the perceived lack of professional development were issues that encumbered the teachers’ development of ICT capabilities. Furthermore, the literature revealed a professional learning and development intervention would be more effective than a professional development intervention (Webster-Wright, 2009). From the analysis of the literature, the communities of practice framework and collective efficacy theory emerged as two constructs to inform the designing of an intervention that would enhance teachers’ ICT capabilities at the research site.

**Communities of practice**

A review of the literature on workplace learning revealed that professional learning and development was most effective when it was long-term and situated “within a community that supports learning” (Webster-Wright, 2009, p. 703), a view shared by many learning scholars (see Darling-Hammond, 1997; Garet, Porter, Desimone, Birman, & Yoon, 2001; Stoll, Bolam, McMahon, Wallace, & Thomas, 2006; Wenger, 1998). Situated learning in schools can engage teachers in learning that addresses authentic issues related to their professional practice (Lave & Wenger, 1991; Oakes & Rogers, 2007). The community of practice framework supported learning, long-term engagement, and timesaving when shared practices result in quickly finding solutions to problems. Furthermore, learning that occurs from participating in a community of practice is more than technical, content and pedagogical knowledge: the learning also influences identity (Wenger, 1998) and potentially motivational beliefs. The following contributions from the community of
practice literature informed the drafting of principles to guide the *ICT community of practice* (ICT CoP) intervention reported in this study.

Wenger’s (1998) learning architecture formalised the dynamics that exist within communities of practice. The dimensions of Wenger’s learning architecture are significant to this research as they describe characteristics where draft design principles could influence learning and engagement. A summary of Wenger’s (1998) learning architecture is presented in Table 2.1.

**Table 2.1: Wenger’s learning architecture (1998, p. 40)**

<table>
<thead>
<tr>
<th>Dualities</th>
<th>Engagement</th>
<th>Imagination</th>
<th>Alignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participation\</td>
<td>Combining them meaningfully in actions,</td>
<td>Stories, laying with forms, recombining,</td>
<td>Styles and discourse</td>
</tr>
<tr>
<td>Reification</td>
<td>interactions and creation of shared histories</td>
<td>assumptions</td>
<td></td>
</tr>
<tr>
<td>Design\</td>
<td>Situated improvisation within a regime of</td>
<td>Scenarios, possible words, simulations,</td>
<td>Communicating,</td>
</tr>
<tr>
<td>Emergent</td>
<td>accountability</td>
<td>perceiving new broad patterns</td>
<td>feedback, coordination,</td>
</tr>
<tr>
<td>Local\Global</td>
<td>Membership, brokering, peripherally,</td>
<td>Models, maps, representations, visits, tours</td>
<td>renegotiation, realignment</td>
</tr>
<tr>
<td>Identification| Mutuality through shared action, situated</td>
<td>New trajectories, empathy, stereotypes,</td>
<td>Inspiration, fields of influence,</td>
<td></td>
</tr>
<tr>
<td>Negotiability</td>
<td>negotiation, marginalization</td>
<td>explanations</td>
<td>reciprocity of power relations</td>
</tr>
</tbody>
</table>

To broaden learning experiences, different perspectives should be encouraged from within and outside of a community of practice as “different organisations bring different perspectives, and often new ideas, to the practice” (Wenger et al., 2002, p. 108). Engaging with and learning from external organisations is an excellent way to gauge how the community’s ICT practices compare to the practices of teachers working in other schools (Wenger et al., 2002). To broaden the learning of ICT practices a community should *facilitate an open dialogue between inside and outside perspectives*.

Individuals have different motivations for participating in communities of practice. They also have different levels of interest and expertise in the communities in which they participate. Furthermore, members of a community will have unequal levels of
participation (Wenger et al., 2002). Some participants will become core members that guide community activities and norms. On the other hand, some community members will remain on the periphery not contributing greatly to the community because of a lack of domain knowledge or other commitments. No matter the level of interest, expertise or participation community members exhibit, learning and meaning can occur through the shared exploration of the practices. Therefore, core members of a community need to invite different levels of participation.

Public events are open to all community members. These events provide opportunity for members to collectively share practices and feel connected to their community by seeing and creating relationships between members (Wenger et al., 2002). Public events also serve as rituals to create a sense of culture within a community. However, most exchanges between members occur day-to-day in private spaces, one-on-one between community members (Wenger et al., 2002). These private exchanges are just as significant as participating in public community events. Consequently, it is important to support the development of both public and private community spaces for members to communicate.

The primary goal of the ICT CoP is to provide professional learning and development around the domain of ICT capabilities for teachers. As the aim of participating in a community of practice is not purely social, the maintenance of membership needs to be an essential factor to consider when designing the ICT CoP. The factors that will encourage teachers to remain engaged in the ICT CoP are discovering that their peers share similar problems, peers are interested in the same topics, individuals have valuable practices that they could share with other members of the community, and there is an opportunity to learn from one another (Wenger et al., 2002). Having an awareness of these factors can help to retain members of the community. Thus, the draft principles need to promote the value of maintaining membership of the community.

As previously stated, the main aim of the ICT CoP is to function as a learning community; nevertheless, as time passes community members have the opportunity to develop friendships that extend beyond professional relationships, and these could
dominate the focus of community participation (Wenger et al., 2002). To ensure the community members’ priorities remain focused on learning about ICT capabilities the draft principles should include a criterion that aims to provide the community with learning experiences that promote the development of ICT capabilities.

Encouraging community members to engage in learning opportunities afforded by their membership to the ICT CoP is significant in achieving the intended outcomes of the community. It is suggested by Wenger et al. (2002) that “events give the community a beat around which other activities happen” (p.62). Furthermore, Gersick’s (1988) research into work teams identified that a group’s progress was triggered more by the awareness of deadlines that an awareness of the work that needed to be completed. Social participation in member-only events can encourage teachers to identify as being more ICT capable than their non-participating peers due to the label attributed to them by default of their participation in member-only ICT CoP events. The formation of identity as one learns, through social participation, is what Wertsch’s (1998) sociocultural approach to learning would identify as the process of appropriation. Consequently, one of the draft principles needed to ensure that an intervention was creating a rhythm for the community members’ interactions.

**Efficacy theory**

Teachers developing their own beliefs in their ability to enhance their capabilities is essential for encouraging participation in professional learning and development, and to motivate teachers to incorporate ICT practices into their lessons. Furthermore, developing teacher collective efficacy beliefs has a number of additional benefits that are listed in Table 2.2.
Teachers participating in the ICT CoP will have a greater chance of transferring learning from a community into their teaching practices if their collective efficacy beliefs for implementing ICT practices are enhanced along with their learning. Furthermore, the effectiveness of teachers’ participation in professional learning and development communities is mediated by their collective efficacy beliefs (Goddard, Goddard, Kim, & Miller, 2015). This intervention aims to enhance collective efficacy beliefs by providing community members with experiences that promote the development of collective efficacy beliefs.

Findings from the initial consultation with practitioners and an analysis of research presented in the literature reviewed in this chapter informed the set of draft design principles developed to guide an intervention at the research site. The draft design principles were selected to enhance teachers’ ICT capabilities and collective efficacy beliefs through their participation in a community of practice. The draft design principles, hereon named the Collective efficacy learning framework, are presented in Table 2.3.
Table 2.3: Collective efficacy learning framework

<table>
<thead>
<tr>
<th>Draft principles</th>
<th>Principle elaboration</th>
<th>Theory/ framework</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Facilitate an open dialogue between inside and outside perspectives.</td>
<td>Affording opportunities for all community members to engage in participatory learning enables members to share practices with one another. In the same way, the expertise that exists outside of a community of practices should be solicited to enhance the learning experiences of community members.</td>
<td>Communities of practice framework</td>
<td>Wenger et al. (2002)</td>
</tr>
<tr>
<td>2. Invite different levels of participation.</td>
<td>Provide opportunities for peripheral participants to engage in community activities as well as opportunities for core member to be accessible to all participants.</td>
<td>Communities of practice framework</td>
<td>Wenger et al. (2002)</td>
</tr>
<tr>
<td>3. Develop both public and private spaces for members to communicate.</td>
<td>Create opportunities for community members to meet as a collective and encourage members to engage with one another outside of collective community events.</td>
<td>Communities of practice framework</td>
<td>Wenger et al. (2002)</td>
</tr>
<tr>
<td>4. Promote the value of maintaining membership to the community.</td>
<td>When individuals value their membership to a community, they understand the worth and benefits of maintaining membership to the community. When members recognise the worth and benefit of a community it creates a sense of intrinsic value that can encourage future participation.</td>
<td>Communities of practice framework</td>
<td>Wenger (1998)</td>
</tr>
<tr>
<td></td>
<td>The enhancement of ICT capabilities and collective efficacy can be delivered through community activities by providing members with experiences that promote mastery learning, vicarious experiences, persuasive interactions, and positive affective states. This is in addition to reflecting on the task of enacting ICT practices in the classroom and evaluating this act in light of the resources available to support teachers.</td>
<td>Collective efficacy theory</td>
<td>Goddard et al. (2000)</td>
</tr>
<tr>
<td></td>
<td>Predictable rituals and events create a ‘rhythm’ for a community that directs the expectations for its members and creates deadlines to encourage accountability.</td>
<td></td>
<td>Goddard et al. (2004)</td>
</tr>
<tr>
<td>5. Provide learning experiences that promote the development of ICT capabilities and collective efficacy.</td>
<td></td>
<td>Communities of practice framework</td>
<td>Wenger et al. (2002)</td>
</tr>
</tbody>
</table>
Summary

Over the last three decades, Australian schools have increased their investment in ICTs in support of teaching and learning efforts. Encouraged by the increased presence of technology along with the future economic and societal impact of technology the Australian government has mandated that educational technology be incorporated into school curricula (ACARA, 2018a). These investments in technology have put a plethora of technology resources in the hands of teachers and the mandates have provided a directive for teachers to incorporate technology into their students’ learning. However, the educational benefits of incorporating technology into learning have lagged behind its true potential (OECD, 2015). As long as teachers wish to take advantage of the learning opportunity educational technology can afford it is of vital importance that they participate in professional learning and development to improve their ICT capabilities.

The literature reviewed in this chapter has helped to elucidate the significant issues surrounding teachers’ ICT practices. Furthermore, the literature review has informed the draft design principles that were used to design the professional development and learning intervention implemented in this study.

The next chapter describes the methodology employed in this study that aspired to answer the research question and contribute to the field of education by exploring the relationship between community of practice participation, collective efficacy beliefs and ICT capabilities. The results of which can be used by schools seeking to support teachers’ collective efficacy beliefs and ICT capabilities through professional development and learning.
Chapter 2 described the significance of this research project and how it is situated within the teacher professional development, educational technology, and efficacy literature. This chapter describes how a case study methodology was employed to explore the influences on and effectiveness of an ICT-devoted community of practice intervention. In this chapter, the methodological considerations, the data collection instruments and their delivery, and the teachers who participated in this study are described. The first section begins with a rationale for selecting the design-based research (DBR) approach and an overview of how each phase of this approach directed the design and testing of principles that guided the implementation of a professional learning and development intervention based on the community of practice framework.

**Design-based research approach**

The intention of this research was to find an ecological approach to enhance teachers’ ICT capabilities and at the same time better understand how school contexts influenced teachers’ engagement in a community of practice. The justification for this line of research is that teachers with proficient ICT capabilities will have access to a broad range of digital skills and pedagogies to support the learning outcomes of their students. To achieve the desired aims of this research project, a design-based research approach was employed.

The design-based research approach supported an emic understanding of the problem as it was explored in its naturalistic setting (Brown, 1992). The design-based research approach afforded an interventionist approach to nurturing teachers’ ICT capabilities and provided an opportunity to develop “new theories, artefacts and practices” (Barab & Squire, 2004, p. 2) through a targeted intervention at the research site.
This research project is not the first time the design-based research approach has been used to study teachers’ use of ICT or efficacy beliefs. In a two-year study, Annetta et al. (2013) used design-based research to deliver a professional development intervention for science teachers. The intervention supported teachers in developing technical pedagogical content knowledge (TPCK) for using video games as educational tools. The study also linked the development of TPCK to the growth of teachers’ self-efficacy beliefs. An additional example is a four-year study conducted by Wang, Hsu, Reeves, and Coster (2014) to optimise the influence of professional development on teachers’ ICT practices. Their research successfully delivered cyber-enabled professional development to positively influence the digital pedagogical practices of 68% of the participating teachers. In a further example, DeSantis (2013) used a design-based research approach to explore how professional development influenced self-efficacy for teaching with an interactive whiteboard. DeSantis’ (2013) study concluded that “sustained, scaffolded, and collaborative professional development” (p. 356) supported the teachers’ technological self-efficacy as well as their development of digital capabilities. The studies mentioned above represent just a few examples of how design-based research has been used to improve teachers’ ICT capabilities and efficacy beliefs. Subsequently, this research aimed to further understanding of how school contexts mediated the co-construction of collective efficacy beliefs. An overview of how the design-based research approach supported this project’s research aims is described in the following section.

**Characteristics of design-based research**

The published literature has described design-based research using a variety of terms, such as *design experiments, design research* and *development research*. Within this body of literature, Wang and Hannafin (2005) eloquently define design-based research as:

> A systematic but flexible methodology aimed to improve educational practices through iterative analysis, design, development, and implementation, based on collaboration among researchers and practitioners in real-world settings, and leading to contextually sensitive design principles and theories (p. 6).
Inquiries that employ a design-based research approach begin with the identification of a problem. The problem is then explored in consultation with the practitioners and a review of the literature is conducted. The participants are not just treated as subjects in a study; they are considered knowledgeable practitioners who can provide insight into the problem under investigation (Goff & Getenet, 2017). Once the problem is defined a theoretical framework that frames the problem is identified. The theoretical framework then informs the development of draft principles that address the problem. The draft principles are delivered as an intervention that addresses the problem in its naturalistic setting through a series of iterative cycles. During each of the iterative cycles data is collected and analysed, again in consultation with the practitioners, to inform an understanding of the problem and to refine the draft principles. Once the draft principles have been refined a set of final principles are presented, along with new insights into the original problem.

Early proponents of the design-based research approach claimed it could provide both theoretical and practical contributions to the educational research sciences (Design-Based Research Collective, 2003). To determine if the design-based research approach had lived up to these claims, Anderson and Shattuck (2012) reviewed a decade of literature on the approach. In their review, they selected the five most-cited design-based research articles each year from 2000 to 2010. Analysing the abstracts from each of these articles, they concluded that there was evidence that the design-based research methodology was increasingly being used as a research approach in the K–12 context and that most interventions “have resulted in improved outcomes or student attitudes” (Anderson & Shattuck, 2012, p. 24).

Anderson and Shattuck’s (2012) review was not without its critics. McKenney and Reeves (2013) presented a respectful critique of the depth of Anderson and Shattuck’s analysis and their conceptualisation of design-based research. McKenney and Reeves supported the overall rationale for the research; however, Anderson and Shattuck’s methodology drew criticism. McKenney and Reeves’ criticised (1) their research strategy, arguing it was limited to the term “design-based research”, thus ignoring research that used alternative terms, (2) their inclusion of articles solely based on the number of citations, arguing it was flawed as it did not distinguish between positive and negative citations, and (3) their omission of books published on
design-based research, as it eliminated a number of significant contributions to the literature (McKenney & Reeves, 2013).

Aside from the disagreement surrounding methodological issues, Anderson and Shattuck’s (2012) review did positively contribute to the design-based research literature by identifying eight basic features that together differentiate the design-based research approach from other research methods:

1. Situated in real educational contexts.
2. Focused on the design and testing of a significant intervention.
3. Supportive of a mixed methods approach.
4. Involves multiple iterations.
5. A collaborative partnership between researchers and practitioners.
6. Supports the evolution of design principles.
7. Design-based research diverges from action research with its focus on developing design principles.
8. Research efforts have a practical impact on practice (pp. 16–18).

Anderson and Shattuck’s (2012) eight basic features of design-based research are reflected in the design of this study, as are the four stages of Reeves’ (2006) design-based research model.

**The rationale for the research approach**

This research project aimed to gain a better understanding of the complex contextual issues that can influence teachers’ ICT capabilities and, in the process, find a solution that could enhance teachers’ ICT capabilities. A pragmatic standpoint influenced the methodological choices while enquiring into this issue. As a consequence, I sought to preserve both the ecological validity (Brunswik, 1943; Lewin, 1943) of the problem and to conduct research that was socially responsible (Reeves, Herrington, & Oliver, 2005). The design-based research approach was able to support the research aims of this study and my standpoint.

As explained in the previous section, design-based approach has been successfully used to explore issues surrounding educative uses of technology (Annetta et al., 2013; DeSantis, 2013; S.-K. Wang et al., 2014). Furthermore, the design-based research approach is viewed as an appropriate model for doctoral research that
focuses on issues related to the instructional use of educational technology (Herrington, McKenney, Reeves, & Oliver, 2007).

Prototypically, design-based research experiments involve designing a theoretically grounded intervention and studying a phenomenon within the context of its deployment (Cobb, Confrey, diSessa, Lehrer, & Schauble, 2003), thereby allowing the intervention to be studied as it negotiates real-world settings. The ecological validity was maintained in this research because the design-based research approach allowed the intervention to be delivered and studied with minimal disruption to the everyday experiences of the teachers who worked at the research site. Furthermore, as the findings were empirically grounded in theory, they are more likely to be generalisable to other real-life settings.

Claims of socially relevant research should be accompanied by the question “relevant for whom?” In the case of this research project, social relevance relates to teachers who use instructional technologies to support the learning of their students and the students who will benefit from their teachers’ accomplished ICT capability. To be socially relevant this research needed to provide a benefit to society in the form of improving teachers’ use of ICT as well as providing a more in-depth understanding of this phenomenon.

**Reeves’s (2006) design research model**

For its ability to inform both theory and practice, and its focus on technological innovation, Reeves’ (2006) design-based research model was selected for this study. This model comprises four iterative stages (Figure 3.1).

![Design-Based Research Model](image_url)

*Figure 3.1: Reeves’ (2006) design-based research model (p. 59)*
Reeves’ (2006) four-stage model allows the researcher to: analyse a practical problem; develop practical solutions to the problem based on existing principles; perform iterative cycles to test and refine the solutions; and produce enhanced design principles. This research project began by identifying the issues encountered by teachers when they designed and implemented ICT-enriched learning experiences for students. These issues were explored through a review of the literature and further consultation with teachers working at the research site. Using the literature review and participant consultation, an intervention was designed and then instantiated at the research site. Once implemented, the intervention was tested and refined through two iterative cycles. Finally, a set of enhanced design principles that addressed the original problem was developed. An advantage of using this approach was that each stage permitted reflexive reflections on the emerging research and findings. The following section describes in more detail how Reeves’ model of design-based research was followed.

**Nature of the study**

The question guiding this research had two objectives: firstly, to identify how contextual factors influenced the co-construction of collective efficacy beliefs for teachers using educational technologies; secondly, to create opportunities for teachers to engage in ICT professional learning and development and to research its potential for transforming teaching practices. To achieve these objectives, a design-based research approach was followed.

**Phase 1: Analysis of the practical problem by researcher and practitioner in collaboration**

At the commencement of this study, I taught in a technology-rich school. During this time, I observed that even the most experienced and competent teachers typically demonstrated limited effectiveness in employing educational technologies. To determine the extent and parameters of the problem it was important to consult with the practitioners “so that the full extent of the problem is known, rather than being interpreted solely by researchers” (Herrington et al., 2010, p. 178). The consultations with practitioners occurred through a range of non-intrusive methods including onsite discussions, observation of group discussions, internal communications (such
as newsletters and emails) and exploring the Principal’s survey to evaluate Heron College’s strategic plan. This rudimentary exploration resulted in the emergence of themes that described some of the main factors influencing the teachers’ use of educational technologies, namely:

- The technology was being used principally for presentations, resource generation, record management and communication rather than higher-order learning and creativity.
- The teachers described a general deficit in their knowledge of educational technologies and persistent challenges with using the technology available to them. Consequently, the teachers identified professional development and the time to engage in professional development activities as potential solutions.

These themes are similar to those derived from the literature reviewed in Chapter 2.

**Stages of ICT learning framework**

It was important to establish an approximation of the teachers’ ICT capabilities before participating in the community of practice to gauge a starting point for promoting effective learning opportunities. To evaluate the teachers’ ICT capabilities, their practices were assessed against the stages of ICT learning framework developed by Schibeci et al. (2008) to identify *an approximation of the participants’ levels of competence*. The stages of ICT learning framework was developed for the Australian context, and based on an earlier framework by Kissane (2003) that modeled the stages of learning teachers progress through when they are learning to integrate graphics calculators into their professional practices. The stages of teachers’ ICT learning framework developed by Schibeci et al. (2008) is presented in Appendix A.

The stages of teachers’ ICT learning framework consists of four incremental stages of ICT capabilities and confidence. **Stage 1: Where’s the on button?** describes a teacher who is learning to become proficient in how a technology functions and is becoming confident in using it. **Stage 2: Black line mastery**, represents teachers who are using technology within the curriculum yet they prefer to rely on the guidance of educational resources provided by other curriculum experts. **Stage 3: Routine student use**, describes teachers who can design learning experiences that utilise technology,
and have also developed a critical capability to discriminate between situations that support ICT use for learning and those that do not. Stage 4: What’s in the curriculum, represents teachers who can “develop and challenge existing curriculum structures and school practices” (Schibeci et al., 2008, p. 320). Teachers who contributed to the data collection described earlier in this chapter described technology as being predominantly used as a presentation tool. They also shared their experiences of having difficulty with technology integration and identified a need for professional development. The use of technology as a presentation tool coupled with a recognised need for professional development suggested that teachers were mostly at the first, and possibly some at the second stage of Schibeci et al.’s (2008) stages of teachers ICT learning framework.

The stages of teacher ICT learning framework used to evaluate the teachers in this study describes a continuum of ICT capabilities and confidence ranging from low to high. To support the inclusion of teacher confidence in their framework, Schibeci et al. (2008) cited the review by Webb and Cox (2004) who argued that “the adoption of ICT by teachers depends on their values and beliefs about the importance of ICT for learning” (p. 276). Bandura (1997) described confidence as “a nondescript term that refers to the strength of belief but does not necessarily specify what the certainty is about” (p. 382). An Australian government department of education supplied the data analysed during the Schibeci et al. (2008) study without the researchers’ input into the methods of data collection. In contrast, the current study had the opportunity to investigate a more specific measure of belief: efficacious beliefs. Efficacious beliefs distinguish themselves from confidence by being a measure of confidence that has a declaration of capability and magnitude of belief (Bandura, 1997).

In addition to achieving a complete understanding of the problem under investigation and the development of a research focus, the activities of Phase 1 provided the background to inform the development of a practical solution in the second design phase. By the end of Phase 1, I had consulted with the practitioners and reviewed the literature in three areas of interest. The consultation with practitioners was presented in Chapter 1. A review of the literature related to teacher collective efficacy beliefs, communities of practice and contexts influencing teachers’ ICT practices was presented in Chapter 2.
Phase 2: The development of solutions informed by existing design principles and technological innovations

Based on the community of practice and efficacy literature reviewed in Chapter 2, along with insights gained from participant consultations, it was identified that professional learning and development was central to enhancing teachers’ ICT capabilities. The most effective form of action was to support participation in a community of practice dedicated to developing teachers’ ICT capabilities. For learning to take place in this context, it is essential to also foster the co-construction of collective efficacy beliefs towards educational technology use (Donohoo, 2017).

Initial support for the community of practice was positive. One-third of the teaching staff expressed interest in participating in the community of practice. By grounding the draft design principles in established theories and principles, it validated their inclusion and potential for mediating a positive effect. The design principles that guided the initial implementation of the intervention and the resulting learning environment were presented at the end of Chapter 2 in Table 2.3.

Once the intervention was designed according to the draft design principles, a community of practice approach to professional learning and development was implemented. Community members met regularly to showcase their ICT practices, learn from other community members, and collaborate on learning design. The draft design principles developed in this study engineered the learning environment to enhance teachers’ ICT capabilities and collective efficacy beliefs. These draft design principles were tested and refined over two iterative cycles. Table 3.1 outlines Anderson and Shattuck’s (2012) basic features of the design-based research approach, together with a brief summary of how each feature was designed for implementation in this study.
Table 3.1: Anderson and Shattuck’s (2012) eight basic features of design-based research

<table>
<thead>
<tr>
<th>Anderson and Shattuck (2012) basic features of design-based research (p. 16)</th>
<th>Research approach used in this research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Situated in a real educational context</td>
<td>The research was conducted in a high school setting. The intervention contributed towards the teachers’ ICT professional development in alignment with their school’s business plan.</td>
</tr>
<tr>
<td>Focusing on the design and testing of a significant intervention</td>
<td>Improving teachers’ ICT capabilities is a significant issue facing Australian schools. This research sought to address the issue of improving teachers’ ICT capabilities by implementing an intervention based on the community of practice model.</td>
</tr>
<tr>
<td>Can use mixed methods</td>
<td>The design-based research approach facilitates a pragmatic methodology. This research utilised a qualitative approach for the data collection and analysis activities. A qualitative approach was most suited to answering the how and why questions this research was investigating. This approach supported in-depth inquiry through the use of semi-structured interviews, participant observations and the collection of artefacts from the research site.</td>
</tr>
<tr>
<td>Involves multiple iterations</td>
<td>The final design principles were refined over two iterative cycles of testing and refinement.</td>
</tr>
<tr>
<td>A collaborative partnership between researchers and practitioners</td>
<td>Collaborating with the practitioners and allowing their perspectives informed this study. The practitioners’ perspectives informed the design of the intervention and helped gain a better understanding of the multiple interpretations of and the complex systems operating at the participants’ workplace.</td>
</tr>
<tr>
<td>Evolution of design principles</td>
<td>After the draft design principles were created, they guided the intervention delivered at the research site. These principles were tested through two iterative cycles. The original principles were refined over the course of the research to create a final set of design principles. This was accomplished by engaging in further reviews of the literature and analysing data collected from the participants.</td>
</tr>
<tr>
<td>Comparison to action research</td>
<td>Like action research, design-based research is applied research that is underpinned by a pragmatic paradigm. Action research is usually conducted to solve a problem or reflect on a process. Nevertheless, design-based research diverges from action research with a focus on developing design principles.</td>
</tr>
<tr>
<td>Practical impact on practice</td>
<td>This research contributed to a better understanding of teacher collective efficacy belief formation. In addition, it provides a set of evidence-based guiding principles for schools wanting to engage their teachers in ICT professional development.</td>
</tr>
</tbody>
</table>

At the conclusion of Phase 2, the intervention was ready for implementation and evaluation.
Phase 3: Iterative cycles of testing and refinement of solutions in practice

The intervention was implemented at the research site during Phase 3, and data were continuously collected to gain a better understanding of how the community of practice enhanced teachers’ ICT capabilities as well as to explore the co-construction of collective efficacy beliefs. Phase 3 also provided an opportunity to explore the effectiveness of the draft design principles and integrate refinements. During this phase, two iterative cycles of implementation and evaluation were achieved.

The concept of a community of practice was introduced to the teachers during two in-school meetings, each held during the first term of the Australian school year. The first session was devoted to acquainting members with one another and negotiating the aims of the ICT CoP. In the second session, I acted as the technology steward and introduced some key concepts, basic ICT skills, and the role of authentic learning experiences.

Following the two initial sessions, support mechanisms were put in place for the community, such as small group meetings, the use of virtual spaces and regular email contacts. The virtual space was created on the school’s LMS to provide ongoing support in the form of forums, blogs, and downloadable resources. After two school terms had passed, the teachers gathered as a group to showcase their skills and share their new knowledge. This iteration was then repeated in the following year. After each iteration, the data were analysed, and refinements were made to the draft principles.

Participants

The participants were purposively selected to include teachers who could remain active in the community of practice for the duration of the two iterations. This criterion for selection was grounded in the motivation to conduct a longitudinal study that could gain an in-depth understanding of the teachers’ perspectives. Acquiring these “rich descriptions” (Denzin, 1989, p. 83) placed demands on time and access to the teachers. Due to the small size of the ICT community, all members of the group who volunteered to participate in the study had the potential to be “information-rich
cases” (Patton, 1990, p. 169) and aid the generalised explanation of co-constructed efficacious beliefs. Consequently, each volunteer was considered for inclusion. Twelve teachers, approximately one-third of the teaching staff, joined the community of practice – enough members to “sustain regular interaction and offer multiple perspectives” (Wenger et al., 2002, p. 37). Like the Takahashi (2011) study into how communities of practice can enhance the co-construction of collective efficacy beliefs, a minimum of four teachers to longitudinally interview was judged to have the potential to provide a rich description of the phenomenon under investigation. Once recruited, it was hoped that all teachers would maintain membership through the two iterations. The time between the initial recruitment of teachers and the end of the second iteration was two years.

The participants in this study included classroom teachers and curriculum leaders. From this point on in the thesis, both the teachers and the curriculum leaders are collectively referred to as teachers to maintain anonymity. To recruit the participants, I presented an overview of the study and proposed intervention during a full staff meeting. The presentation outlined the research question, the rationale for exploring the question, an overview of the data collection requirements and assurance that participation was voluntary. Even if they did not wish to participate in the data collection, all teachers at the research site were encouraged to participate in the ICT CoP. To recruit participants, a letter of invitation was distributed to each teacher at the research site. The letter of invitation outlined the participant requirements and ethical concerns that could conceivably arise from participating in the research (Appendix B).

**Research participants**

This section introduces the teachers who participated in the data collection. Each teacher is listed along with their teaching career stage, how long they had taught at Heron College at the commencement of the study, their experience with technology, and any information relevant to their involvement in the project. In the interests of protecting the participants’ privacy, all names and some genders have been changed. Furthermore, the career stages of each participant have been based on the following
criteria: early career (0–7 years), mid-career (8–23 years), and late career (over 24 years) (Kington, 2012).

**Participant: Melissa**

Melissa was a mid-career teacher who had worked at Heron College for between 5 and 10 years. Like many of her colleagues, her teaching load included both lower and upper secondary classes. In the past, Melissa had regularly participated in the school’s community life but with growing family commitments her more recent contributions, beyond her essential workload, had lessened. Joining the ICT CoP was a way Melissa believed her employer could see her as proactively engaging in and contributing to the school community, in addition to improving her ICT capabilities.

During the second iterative cycle, Melissa secured employment at another school. She credited some of her success in securing the new role to her participation in the ICT CoP. Melissa’s impending departure from the school could have contributed to her willingness to openly share more candid work experiences during the final semi-structured interview.

**Participant: Carol**

Carol was a mid-career teacher who had worked at Heron College for around 10 years. Like many of the teachers who had been employed by the College in its early years of operation, she had remained loyal to the school and maintained a strong belief in the College’s ability to add value to its students’ lives. In her professional practice, Carol liked to experiment with new technologies. A contributing factor to Carol’s eagerness to participate in the ICT CoP was her view that it was important for students to become digitally literate by the time they left school.

**Participant: Enoch**

Enoch was another mid-career teacher who had been a long-serving member of the school. He had taught at Heron College for around 10 years and during this time found the requirement to invest time and money into ICT as an imposition. Nevertheless, in the time leading up to the intervention, he had begun to embrace technology and quickly found it becoming a regular part of his lessons and recreational time.
Participant: Sung-ho

Sung-ho was a mid-career teacher who had worked at Heron College between 3 and 5 years. He was a proactive teacher who worked tirelessly to champion various school initiatives. Before joining the ICT CoP, Sung-ho had been an avid user of digital technologies and was quick to lend his support to the ICT CoP.

Participant: Jason

Jason was a mid-career teacher who had worked at Heron College for around 10 years. Jason became a strong advocate of the ICT CoP. He began participating in the community with a keen interest in developing his ICT capabilities and using a greater amount of ICT with his students. However, he consistently struggled to engage with the community due to a demanding workload and commitments outside of the workplace.

The ICT CoP started with 12 members. Six of these members volunteered to become research participants. Over the two-year duration of the research project, the community of practice was reduced to seven members, five of whom were participants in this research project. The five members who left the ICT CoP left because they were following employment opportunities at other schools. The data collection began at the beginning of the Australian school year and concluded 23 months later, at the end of the following year.

Method of evaluation

Informed by a constructivist perspective, this research project sought to understand the phenomena of co-constructed collective efficacy beliefs and their impact on teachers’ ICT capability. This was achieved by accessing the participants’ perspectives (Patton, 1990) and by observing the environment where the participants used their ICT practices. I wanted to examine how teachers at the research site developed collective efficacy beliefs and how this related to the growth of their ICT capability. Yin (2003) claimed that “case studies are the preferred strategy when how or why questions are being posed when the investigator has little or no control over events, and when the focus is on a contemporary phenomenon within some real-life context” (p. 1). Furthermore, Yin described the case study method as a suitable research strategy to use when an empirical enquiry is investigating a phenomenon...
where the boundaries of the phenomenon and the context are not clearly defined. For these reasons, the case study methodology was selected as an appropriate method to achieve the research aims.

The data collection comprised of a single case study with embedded, multiple units of analysis to examine the teachers’ co-constructed collective efficacy beliefs and their impact on ICT capability. The multiple instances of unit analysis were comprised of the experiences of teachers from the research site.

**Data collection methods**

Qualitative data were collected at the beginning of the study and the conclusion of both the first and the second iterations. Also, I collected artefacts that were generated in the public sphere of the school, and kept a journal to record significant events and observations. The choice to collect qualitative data was due to the nature of the research question; also, the small number of participants allowed an in-depth investigation of significant issues. A summary of the data collection events and methods is presented below, in Figure 3.2.

![Figure 3.2: Outline of data collection events and methods](image-url)
**Initial survey**

The consultation with practitioners and the literature review, both completed in Phase 1, provided a sound basis for creating the first set of survey questions. The initial survey was created to gain a broader understanding of the teachers’ technology use and identify factors influencing the teacher’s efficacy and use of technology. At this early stage, the co-construction of teachers’ efficacy for ICT use was not examined due to the limited time the group had shared together. The initial survey explored the participants’:

- background use of educational technology,
- benefits and challenges of participating in a community of practice,
- benefits and challenges presented by the physical environment,
- the school community’s influences on teacher ICT use.

The participants recorded written responses to each question on the survey. A copy of the full survey is presented in Appendix C.

**Semi-structured interview: Iteration 1**

The results of the first survey highlighted a need to gather more information about the scope and impact of the contextual factors that could influence the teachers’ collective efficacy for technology use. To identify possible lines of inquiry, a matrix was created that mapped the College’s contexts that could have influenced the teachers’ technology use. The College contexts included:

- Physical environment
- Students
- Teachers
- Leadership
- Community perception
- Digital technology resources

These categories were mapped against:

- individual efficacy,
- collective efficacy and
- power.

Once the questioning matrix was constructed, questions were crafted to explore each dimension of the matrix (see Appendix D). The questions were crafted to assess each
dimension’s perceived impact on the teachers’ collective efficacy beliefs and to uncover the mechanisms through which the teachers co-created collective efficacy beliefs. Particular attention was given to gaining a greater understanding of the precedents of collective efficacy by crafting questions that could explore two constructs from the Goddard et al. (2000) and Goddard et al. (2004) model of collective efficacy; namely, task analysis and judgments of competence. The participants’ responses to the semi-structured interview were audio recorded and later transcribed. The second semi-structured interview schedule is presented in Appendix E.

Additional data sources included a journal kept by me, recording of observations from onsite discussions, a collection of internal communications (such as newsletters and emails), and the Principal’s survey, which reviewed Heron College’s strategic plan.

**Semi-structured interview: Iteration 2**

The second iteration was informed by the first iteration’s data analysis and provided an opportunity to reflect on unanswered aspects of the research question and potential areas of further inquiry. Subsequently, the second set of semi-structured interview questions were crafted with the aim of collecting data to:

- further explore how each of the defined context dimensions was influencing the teachers’ co-construction of collective efficacy beliefs,
- explore the impact of community participation on the teachers’ ICT capability, and
- assess the outcomes and effectiveness of the intervention.

At this stage, the lines of inquiry related to issues of power were not pursued. It was determined that the participants were not forthcoming and comfortable in providing answers to this line of investigation. Consequently, I decided not to delve further into this theme with the participants. Like the first semi-structured interview from Iteration 1, the participants’ responses to the second semi-structured interview were audio recorded and later transcribed. The final iteration’s semi-structured interview schedule is presented in Appendix F.
Administration of the instruments

The first instrument used to collect data was the initial survey. A copy of the survey, a letter describing the instrument, and a return envelope were distributed to each participant via their individual pigeonholes. The teachers were able to complete the survey at their leisure in a location of their choice. Once the teachers completed the surveys, they were asked to seal their response in an envelope and return the survey to my work pigeonhole.

To gather a richer description of the participants’ perspectives, a round of semi-structured interviews followed each of the intervention’s iterations. These semi-structured interviews were conducted on student-free days in the school’s vacant classrooms or off-site at local cafes, if it was more convenient for the participant or if additional privacy was preferred.

In addition to the survey and semi-structured interviews, I periodically recorded field notes and collected relevant documents. The field notes consisted of observations and reflections on the ICT CoP and the broader school context. The documents collected included email communications, newsletters and publicly available school policy documents.

Data analysis methods

A version of Glaser’s (1965) constant comparative method guided data analysis in this study. The constant comparative method of analysis was applied to the initial survey as well as the semi-structured interviews arising from Iterations 1 and 2. During the analysis, cases were viewed holistically, and the core themes emerged conjuncturally, from a contextually focused analysis of significant themes. As a result, the analysis is abstractly causal rather than being historically defined. Figure 3.3 presents a schematic representation of how Glaser’s (1965) four-stage model was used in this study.
Glaser’s (1965) constant comparative method was used in conjunction with Scott’s (2004) conditional relationship guide and reflective coding matrix to analyse the data. The following sections describe how these guides were used during the data analysis.

**Stage 1: Comparing incidents applicable to each category**

After transcribing the interviews, each transcript was read to become “sensitised” to the data. Next, the transcripts were openly coded (Glaser & Strauss, 1967; Strauss & Corbin, 1990) by adding codes (temporary constructs) next to each significant incident in the page margins. These codes were based on sentences or multi-sentences. These temporary constructs identified various categories that could address the research question. During this initial phase of coding, the constant comparison method of analysis was employed.

Each time an incident was coded with an existing code, each newly coded incident was compared to previously identified incidents. Similarly, coded incidents were compared within each interview and then between interviews. By using this constant comparison, ideas about the possible themes, connecting various categories, began to emerge. As categories emerged, memos were used to document the nature of them. Once no new codes were emerging from the data, attention turned to an analysis of the incidents and the properties of these categories.
To manage the coding process, each interview was transcribed and uploaded to the web application Dedoose. Dedoose allowed codes to be applied to the interview transcripts and provided features to add memos and identify code frequency and demographic data. An example of the coding activity is provided in Figure 3.4 and examples of memos recorded during these activities are presented in Figure 3.5.

![Dedoose](image)

**Figure 3.4: Data coding example**

![Memos](image)

**Figure 3.5: Memo examples**

Once categories could be identified from the codes, data recording and analysis continued with the use of matrices (Miles, Huberman, & Saldana, 2014) created in Microsoft Word. Examples of the matrices created during the data analysis are presented later in this chapter in Tables 3.2 and 3.3.
**Stage 2: Integrating categories and their properties**

During the second stage of data analysis, axial coding was performed. A comparison was made between the incidents and the properties of the categories to which they had been assigned. Owing to the properties of related categories being combined with one another, a more detailed description of secondary order constructs began to emerge from the data analysis. To guide the process of axial coding, the advice of Strauss and Corbin (1998) and Scott (2004) was followed.

When using the constant comparative method to axially code, Strauss and Corbin (1998) advised researchers that “when analysts code, they look for answers to questions such as why or how come, where, when, how, and with what results, and in so doing they uncover relationships among categories” (p. 127). Seeking answers to these questions helped to contextualise the emergent categories. To formalise Strauss and Corbin’s process of axial coding, Scott’s (2004) conditional relationship guide was employed. The guide is a formalised version of the advice as mentioned above provided by Strauss and Corbin (1998), developed by Scott (2002) during her research on high self-efficacy in adults committing to new challenging pursuits. In using Scott’s (2004) framework, the following questions were answered to contextualise each of the initial categories:

- What is [the category]?
- When does [the category] occur?
- Where does [the category] occur?
- Why does [the category] occur?
- How does [the category] occur?
- With what consequences does [the category] occur or is [the category] understood? (pp. 115–6).

A feature of using this guide is that it helped to “contextualize the central phenomena and relates structure with process” (Scott, 2004, p. 113) in addition to making the systemisation and traceability of data analysis more transparent. A sample conditional relationship guide produced during the data analysis is presented in Table 3.2.
<table>
<thead>
<tr>
<th>Category</th>
<th>What is the category?</th>
<th>When does the category occur?</th>
<th>Where does the category occur?</th>
<th>Why does the category occur?</th>
<th>How does the category occur?</th>
<th>With what consequence does the category occur or is the category understood?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social activism to undermine leadership</td>
<td>Technological activism</td>
<td>Students complaints were encouraged to be put into action</td>
<td>Students organising themselves into a group</td>
<td>Dissatisfaction with technology</td>
<td>Students boycott bringing laptop to school and put their names to a petition</td>
<td>The students were listened to, and the internet access became less restrictive for them</td>
</tr>
<tr>
<td>Boundary crosser</td>
<td>Barrier crosser</td>
<td>Teachers communicate to the IT staff</td>
<td>IT help desk</td>
<td>One of the IT department taught and worked in IT support</td>
<td>Teaching part-time in two different departments</td>
<td>The IT department understood the needs of the teachers The teachers rely on them and their support</td>
</tr>
<tr>
<td>Removal of boundary crosser</td>
<td>Boundary crosser dismissed</td>
<td>Between iteration 1 and 2</td>
<td>Heron College</td>
<td>School retention issues</td>
<td>Redundancy</td>
<td>The IT department ignored the needs of the teachers</td>
</tr>
<tr>
<td>Leadership motivation to use ICT</td>
<td>Leadership’s motivation to use ICT</td>
<td>Classrooms</td>
<td>Marketing</td>
<td>Increase enrolments and retention</td>
<td>Funding is applied for and spent on IT infrastructure</td>
<td>The network is upgraded to deal with the bandwidth requirements Sets of laptops are purchased</td>
</tr>
<tr>
<td>Seductive details</td>
<td>Edutainment</td>
<td>Gain the attention of students</td>
<td>Classroom</td>
<td>Engage students in the activity of learning</td>
<td>Digitally inserting seductive details into teacher presentations</td>
<td>Students find their learning experiences to be more entertaining No significant difference in what they are learning.</td>
</tr>
</tbody>
</table>
After the conditional relationships between codes had been identified, a search for core categories could commence.

**Stage 3: Delimiting the theory**

To further examine the relationships between categories and identify core categories, Scott’s (2004) reflective coding matrix was utilised. Employing the reflective coding matrix also supported the delimiting of the theory (Glaser, 1965) by helping focus the analysis on a limited number of contexts and reducing the number of categories under consideration. A sample reflective coding matrix is presented in Table 3.3.
**Table 3.3: Sample reflective coding matrix**

<table>
<thead>
<tr>
<th>Reflective coding matrix</th>
<th>Direction-setting leadership practices</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Core category</strong></td>
<td><strong>Priority</strong></td>
</tr>
<tr>
<td><strong>Properties</strong></td>
<td><strong>Demands</strong></td>
</tr>
<tr>
<td><strong>Processes</strong></td>
<td><strong>Time</strong></td>
</tr>
<tr>
<td><strong>Dimensions</strong></td>
<td><strong>Limited time</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Not observing peers’ teaching practices</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Large workload</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Limited time to engage in professional learning</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Mastery experiences limited to the classroom.</strong></td>
</tr>
<tr>
<td><strong>Contexts</strong></td>
<td><strong>School</strong></td>
</tr>
<tr>
<td><strong>Modes for understanding the consequences</strong></td>
<td><strong>Limited opportunity to develop CE through vicarious experiences</strong></td>
</tr>
<tr>
<td></td>
<td><strong>The high workload demands are limiting opportunities to participate in the ICT CoP</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Limited opportunities to engage in mastery learning.</strong></td>
</tr>
</tbody>
</table>

64
Stage 4: Writing the theory

An analysis of the conditional relationship guides revealed that the category labelled as contexts would provide the basis for building a relational hierarchy and resulted in categories being grouped according to their contexts. As a result, one context was represented on each reflective coding matrix, as in Table 3.3. Next, the dimensions of each category and modes for understanding were evaluated and entered into the reflective coding matrix. Once completed, the dimensions and modes for understanding were used to constructively identify the processes and properties represented by each category. Finally, the core categories were holistically constructed by examining each of the reflective coding matrixes in its entirety. At the end of this process, the core categories provided a means for understanding the central phenomena of the study.

The processes described in Stages 2 and 3 were not linear. At many points during the completion of the conditional relationship guide, the transcripts were revisited and codes modified as they were reinterpreted, as the relationships between the categories were more clearly understood. Likewise, during the completion of the reflective coding matrix, the conditional relationship guide was revisited and modified to help inform an understanding of the major themes.

Trustworthiness and credibility

To ensure an ethical approach was followed, the research was conducted under the review of the Murdoch University Ethical Review Board, including the following processes:

Informed consent and the minimisation of harm

The principal of Heron College provided informed consent to conduct research and deliver an intervention at the research site. The data collection activities included interviewing teachers and collecting artefacts from the research site, including and not restricted to internal communications and operational documentation — the proceedings of which could be included in the data analysis and presented in this thesis. Furthermore, informed consent was sought from all participants at the research site. Only data from teachers who consented to participate in the research
was used in this study. Therefore, interview data that included comments from nonparticipants were omitted from the data collection and analysis. In addition, the research agenda was disclosed to all participants and nonparticipants at the research site.

*Relationship between researcher and researched.* Throughout the research, I was sensitive to the effects of the research on the participants. The confidentiality of the participants was guaranteed to protect them from any negative consequences, and recognition that each participant’s primary responsibility was with their students. Furthermore, throughout the process, and in line with the design-based research approach, I consulted with the participants to ensure that they were significantly involved in the research.

**Benefits of the research**

The benefits of the research to the practitioner and broader community was:

- The participants received professional learning and development to support the implementation of ICT into their teaching practices. At the end of the study, the participants were expected to have gained an increase in their self-, teacher, and collective efficacy beliefs for ICT use.
- The wider community included students in Years 7 to 12 at the research site. It was believed that these individuals would also benefit from the research. By implementing more sophisticated ICT practices, teachers can provide their students with learning experiences that are: rich, motivational, and developing technology literacy. It should be noted that this outcome was neither measured nor validated.

The credibility and validity of the research is of utmost importance in qualitative research. How credibility and validity was supported in the research project is outlined in Table 3.4.
Table 3.4: Procedures to ensure validity

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Implementation</th>
</tr>
</thead>
</table>
| Structural corroboration or triangulation through the use of multiple sources of data (Denzin, 1978; Denzin & Lincoln, 1994; Yin, 2003). | • Corroboration by data source, persons (teaching peers), times (before and after each intervention), and by method (observation, interview, documentation).  
  • Data triangulation was achieved by collecting evidence from multiple sources and cross-checking the consistency of data from multiple sources of evidence.  
  • A case study database was created to organise and store data collected during the research. The case study database consisted of notes, documents, and narratives gathered from each source of evidence. |
| Collection of referential materials; e.g., documents, emails, website forum posts, and audio recordings against which findings can be tested (Guba, 1981). | • Forum and blog discussions were recorded, recording of teacher interviews, collection of College communications; e.g., newsletters and participant observations. |
| Consensual validation, or agreement among other researchers that the description and interpretation of the research is correct (Guba, 1981).                                                  | • The research proposal was reviewed by external reviewers (academics) as part of Murdoch University’s EdD requirement.  
  • The seeking of opportunities to present the findings of the proposed research at conferences or as published journal articles. |
| Looking for negative evidence (Miles & Huberman, 1994).                                                                                   | • Identification of negative instances and careful consideration of “the proportion of negative to positive evidence” (Miles & Huberman, 1994, p. 271).            |

Note on the editing of quotes

To improve the comprehensibility of quotes, some of the interviewee’s original statements were edited to make them more readable. For example, the sentence below, taken from one of the quotes included in Chapter 6, is the most significantly altered quote presented in the data analysis chapters.

Original quote

So, the problem is there are with students is that they become very cynical of the use of a particular strategy when they can’t have access to the online portal or it’s down or systems fail in some way, and students become a little more. (Carol, Semi-structured interview 2)
Revised quote

The problem is students become very cynical of a particular strategy when they can’t access the online portal, or it’s down or systems fail in some way.

(Carol, Semi-structured interview 2)

If editing was required, it occurred only when the message conveyed in the original quote could be preserved without distortion.

**Phase 4: Reflection to produce ‘design principles’ and enhanced solution implementation**

In Phase 1, an in-depth understanding of the problem and the context surrounding the teachers’ competence to employ digital technologies was gained. This in-depth understanding of the problem informed the development of a solution that took the shape of draft design principles that guided the learning environment implemented during Phase 3. Two iterative cycles of testing and data collection were performed in Phase 3 to test and refine the original draft design principles. Consequently, Phases 1 to 3 informed the development of the final design principles during Phase 4. These final design principles are presented in Chapter 6. The final design principles, engineered during Phase 4 of the study, can be used by school leaders to nurture teachers’ ICT practices as well as by researchers whose aim is to pursue similar research agendas.

**Summary**

This chapter described the research approach and methodology employed in this study. It described the design-based research approach, the participants, the data collection and the data analysis. The following chapter describes the intervention implemented in this study.
Chapter 4: 

Design of the Learning Environment

The work conducted during Phase 2 of the design-based research approach centred on the development of solutions to the problem and designing the intervention. During this phase, draft design principles were derived from the consultation with practitioners (Chapter 1) and literature review (Chapter 2). This chapter describes the design of the learning environment created to enhance the ICT capacity of teachers participating in a community of practice intervention.

Issues guiding the design of the intervention

Conversations with teachers and anecdotal observations provided the first indications that the teachers at the research site needed support to enhance their ICT capabilities. The initial exploration of the research site revealed relatively low-level uses of educational technology by teachers and also identified many issues confronting teachers who were attempting to incorporate ICT into their professional practices (see Chapter 1).

The literature reviewed in Chapter 2 identified the communities of practice framework (Wenger, 1998) and collective efficacy beliefs (Bandura, 1997) as constructs that could help address the problem. From an analysis of these constructs, a guiding conceptual framework was created, influenced by Wenger’s (2010) learning architecture and Goddard, Hoy and Hoy’s (2000, 2004) model of teacher collective efficacy. The guiding conceptual framework guided the development of the draft design principles presented at the end of Chapter 2 (refer to Table 2.3). The following section describes an overview of the participants’ engagement in the ICT CoP intervention and the roles I fulfilled as researcher within the ICT CoP, followed by a description of how each draft design principle was operationalised at the research site.
**Researcher roles**

My employment at the research site allowed me to collect data as a participant observer. This role provided opportunities to collect data at the source and readily consult with practitioners. The delivery of a community of practice intervention to enhance ICT capabilities and promote the co-construction of collective efficacy beliefs required me to take an active role within the ICT CoP. Consequently, the roles I fulfilled included technology steward, core member of the community of practice, friend and colleague, as well as researcher.

**Technology stewardship**

Wenger, White and Smith (2010) define a technology steward as someone who “adopts a community’s perspective to help a community to choose, configure and use technology to best suit its needs” (p. 24). These authors claim that the technology steward’s role is different from the role of an IT support person. The technology steward has an “insider’s perspective” on what would be an appropriate fit for the community in a more informed way than an IT support person. Consequently, in the role of the technology steward, I organised and guided many of the professional learning and development activities in line with the community members’ needs.

**Core member**

Core members participated in the community of practice as learners as well as being influential in providing domain-specific knowledge and guiding the practices of the more peripheral members. As a core member, I actively participated in activities that honed my pedagogical knowledge and ICT capabilities. I also contributed towards the learning opportunities of other community members.

**Friend and colleague**

During the intervention, I maintained friend and colleague relationships with the participants. Most of the participants had worked with, and known me, for the duration of their employment at Heron College.
Collective efficacy learning framework in practice

Presented in this section is a description of how each draft design principle was instantiated or operationalised at the research site. These draft design principles were as follows:

- Facilitate an open dialogue between inside and outside perspectives.
- Invite different levels of participation from the participants.
- Develop both public and private spaces for members to communicate.
- Promote the value of membership to the community.
- Provide the community with learning experiences that promote the development of ICT capabilities and collective efficacy beliefs.
- Create a rhythm for the community members’ interactions.

Review and refinement of the draft design principles were ongoing processes that occurred throughout the implementation of the intervention and data analyses. Chapter 7 presents the final design principles.

Facilitate an open dialogue between inside and outside perspectives

Community members were provided with opportunities to share insider perspectives in several ways: electronically through online forums, one-on-one with other community members, and during planned meetings. On Heron College’s LMS, forums were created to encourage information sharing between community members and create a repository of community artefacts. The forum attracted early interest from participants and it quickly became a repository of hyperlinks, self-help information and a schedule of community events. As well as the attempt to cultivate an online presence for sharing insider perspectives, meetings were held in the middle of each of the four Australian school terms. The activities that took place during these meetings included: showcasing ICT practices, presentations, and the ad hoc sharing of practices.

The introduction of outside perspectives was achieved by identifying community members’ level of ICT capacities and then introducing boundary objects and opportunities for boundary interactions that extended the community members’ ICT
capabilities. These boundary objects consisted of learning opportunities from outside organisations and presentations from outside experts.

**Invite different levels of participation from the participants**

To invite different levels of participation from the participants, core community members availed themselves to all community members and provided advice and help with problem-solving on a day-to-day basis. Furthermore, the core members showcased their practices at community meetings and encouraged all participants to take turns in showcasing the ICT practices they had implemented in their classrooms. Some examples of the showcases included:

- sharing students’ use of PowerPoint to demonstrate their understanding of Aboriginal culture,
- demonstrations on how to use Microsoft Word’s developer tools,
- showcasing experiences of using student-created videos as a form of assessment,
- tutorials on how to create assessment items on Heron College’s LMS.

These showcases were well received by community members and provided a stimulus for participants to explore new uses of ICT in their teaching practices.

**Develop both public and private spaces for members to communicate**

Public spaces for community members to interact were created through the organisation of regular community meets and the creation of online forums. For each iteration, members of the ICT CoP were invited to attend four community meetings (one per Australian school term) and a closed forum was created on Heron College’s LMS for community members to communicate with each other. The public spaces provided a place for members “to exchange tips, solve problems, or explore new ideas, tools, and techniques” (Wenger et al., 2002, p. 58). These events were public in the sense that they were open to community members.

Private spaces were the spaces in which community interactions took place outside of the public spaces. Private-space interactions consisted of small-group meetings, such as one-on-one conversations. These meetings provided the convenience of convening a limited audience for learning and the negotiation of meaning. To promote discussions in private spaces, I regularly met with members on an ad hoc
basis to engage them in conversation related to ICT practices and offer support. Promoting teachers’ engagement in collaborative planning and problem solving were the main ways teachers were encouraged to collaborate in private spaces. The teachers valued private space interactions; however, at times, they struggled to prioritise these interactions over their everyday work demands.

**Promote the value of membership to the community**

Perceptions of value can keep community members engaged in the activities of communities of practice (Wenger, 1998). This principle was achieved through stewarding learning that targeted the improved ICT practices and through identifying and addressing problems that were relevant to the community. In both public and private spaces, the teachers shared their learning goals and any problems they were experiencing. This information was used either to provide individualised assistance or guide the topics core members would present at community meetings.

**Provide the community with learning experiences that promote the development of ICT capabilities and collective efficacy beliefs**

Face-to-face meetings and email communications provided opportunities to promote ICT capabilities and collective efficacy beliefs. Face-to-face meetings provided opportunities to support learning by:

- showcasing and promoting individual successes,
- helping teachers problem-solve when they encountered issues with ICT practices,
- sharing knowledge about ICT practices that engaged students and promoted learning,
- providing messages that persuaded teachers to form beliefs that they had the competence and available resources to enact their ICT practices, and
- promoting teacher engagement in activities related to the ICT CoP.

In the community of practice social learning system, learning, meaning, identity and efficacious beliefs are inextricably linked; consequently, the examples listed in the dot points above promoted both learning and efficacious beliefs.
Create a rhythm for the community members’ interactions

A rhythm for the community’s interactions was created through regular, once-a-term opportunities to meet as a community, and through regular email communications about community activities. The emails provided information about scheduled events, shared knowledge and celebrated the members’ activities (an example email is presented in Appendix G). Furthermore, during each of the four Australian school terms, all ICT CoP members were invited to convene as a group. Each meeting provided opportunities for the teachers to share practices, learn about ICT and problem-solve. These regular meetings provided a measure of accountability for the participants as it became a cultural norm that members would develop their ICT practices and then report their experience back to the community. A meeting agenda from one of the community meetings held during the first iteration is presented in Appendix H.

Pre-intervention

Before the intervention, all teachers at Heron College were invited to participate in the ICT CoP. Those teachers who chose to participate in the community brought with them mostly novice ICT capabilities.

Intervention: Community of practice

Participation in the intervention provided opportunities for teachers to negotiate a shared understanding of what it meant to use ICT in a secondary context for teaching and learning. Participation in the ICT CoP provided a setting to collaboratively problem-solve and access professional learning and development. Through their participation in community-related activities, the teachers had the opportunity to enhance their ICT capabilities and, in the process, cultivate their identity as ICT practitioners and co-construct collective efficacy beliefs.

Post-intervention

By the end of each iterative cycle of the intervention, the teachers had engaged in professional learning and development that aimed to enhance their ICT capabilities and co-construct collective efficacy beliefs. At the beginning of the study, it was expected that those teachers who entered the ICT CoP as peripheral participants
would have opportunities to move towards becoming core members of the ICT CoP. However, this expectation was neither necessary nor realised. Over multiple iterations, members may have transitioned from peripheral to core members of the group, but this did not happen during the two-year intervention. At the end of the intervention, the group enhanced their ICT capabilities and identity within the contextual demands of the research site.

A model depicting the participants involvement in the ICT CoP intervention is presented in Figure 4.1. The model recognises that prior to participating in the ICT CoP intervention, individuals brought with them ICT capabilities and collective efficacy beliefs. As the participants engaged in each iteration of the intervention, they co-participated in professional learning and development and in the process had opportunities to develop their ICT capabilities and collective efficacy beliefs through socially shared cognitions and reflective practices. Post intervention, the participants increased their ICT capabilities and modified their collective efficacy beliefs.

![Figure 4.1: The development of ICT competencies and collective efficacy beliefs for ICT CoP participants](image)

The following section describes the data analysis of the draft design principles that comprise the Collective efficacy learning framework from the participant interviews and my field notes journal. The data analysis followed Glaser’s (1965) constant comparative method and the results of the analysis guided refinements to the delivery
of the Collective efficacy framework during Iteration 2, as well as informing refinements to the draft design principles.

**Reflections on the draft design principles – Iteration 1**

The first iteration was implemented at the beginning of the Australian School year and continued for the duration of the school year. The intervention began with 12 members, out of which seven members consented to participating in this study. Towards the end of the first iteration, one member withdrew from the study to work at another school, and asked that their data be omitted from the data analysis. Interviews with the participants and my reflections on the implementation of the Collective efficacy learning framework were used to reflect on the success of the draft design principles and identify potential refinements.

**Technology steward’s reflections**

During Iteration 1, the reflections and observations that resulted from my role as the technology steward were recorded in a field notes journal. These reflections concurred with those expressed by the participants in this study by identifying time, access to expert knowledge, technical issues and access to peripheral technology resources as areas of potential improvement.

All teachers in this study reported that workload commitments reduced their time to engage in ICT professional learning and development. At the beginning of the first iteration, some teachers found their work schedules prevented them from attending meetings until Heron College’s leaders supported the teachers’ participation, thus allowing all members to attend all meetings. Workload demands provided a challenge to the teachers yet, regardless of this challenge, the teachers found enough time to productively engage in the ICT CoP during the first iteration.

Another issue experienced by community members was the need for timely access to expert knowledge and a wide range of knowledge to be held collectively in the fledgling community. The core members’ busy schedules frequently prevented them from providing timely assistance to teachers and the limited capacity of twelve community members to hold the technical knowledge to answer every question proved to be a problem. Sometimes having to wait for help to problem-solve resulted
in delayed implementation of an ICT-based activity or the abandonment of a planned activity.

In the field notes journal, it was noted that members of the ICT CoP never adopted the online forums as a communication tool to share insider perspectives due to technical issues. The discussions started in the forums were eventually abandoned in favour of face-to-face and email communications. A large problem with posting messages to the forums was that they did not notify community members that new posts had been created. This lack of notification caused delays in teachers reading forum posts, thus making them seem less current or important because time had passed between posting and reading.

Access to peripheral devices in the classroom was problematic for many teachers in this study. All teachers in this study had access to laptop computers; however, there were not enough data projectors or audio speakers for each classroom. This presented a significant issue for the teachers who wished to present digital media to their students. Consequently, digital resourcing provided a source of frustration for teachers when the loan projectors/speakers were not returned quickly enough for them to be accessed by the next teacher, which happened frequently due to the distance of the classrooms from one another. More peripheral devices were required to facilitate regular ICT in the classroom.

**Recommended improvements**

Insights from the participants as well as my reflections on stewarding the ICT CoP were mapped against each element of the *Collective efficacy learning framework* to identify potential refinements to the draft design principles. The issues and recommendations identified to improve the draft design principles for the implementation of Iteration 2 are presented in Table 4.1.
Table 4.1: Iteration 1 – Issues and recommendations

<table>
<thead>
<tr>
<th>Draft principles</th>
<th>Issues</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Facilitate an open dialogue between inside and outside perspectives.</td>
<td>Time limitations provided a challenge to discussing ICT practices in private spaces. Some participants were able to attend the first public ICP CoP meeting.</td>
<td>Encourage the use of asynchronous communication (e.g., email) in place of face-to-face meetings by initiating group discussions.</td>
</tr>
<tr>
<td>2. Invite different levels of participation.</td>
<td>No issues identified.</td>
<td></td>
</tr>
<tr>
<td>3. Develop both public and private spaces for members to communicate.</td>
<td>The forum was not used to support discussion. The forum was used as an information repository. The teachers did not participate in classroom observations of each other’s ICT practices. At times, members struggled to find time to participate in activities related to the ICT CoP. The forum did not notify members about new posts. The email feature of the LMS did not work.</td>
<td>Use the forums solely as a repository of information. Use email to asynchronously contact members.</td>
</tr>
<tr>
<td>4. Promote the value of maintaining membership of the community.</td>
<td>Many teachers wanted a close peer to be a member of the community to support their learning/interest.</td>
<td>Regularly promote membership of the ICT CoP to non-members.</td>
</tr>
<tr>
<td>5. Provide learning experiences that promote the development of ICT capabilities and collective efficacy.</td>
<td>The core members were not always available to help other members with their questions due to time limitations. Access to computer labs was limited. Some teachers were unable to access data projectors/audio equipment in their classrooms.</td>
<td>The ICT CoP members needed additional boundary objects (i.e., EPIC) to support timely learning and problem solving. Promote the sharing of technology resources between ICT CoP members.</td>
</tr>
<tr>
<td>6. Create a rhythm for the community members’ interactions.</td>
<td>No issues identified.</td>
<td></td>
</tr>
</tbody>
</table>

The recommendations to the professional learning and development intervention, listed in Table 4.1, were instantiated in the second iteration. The impact of these changes and the events of Iteration 2 are described in the following section.
Reflections on the draft design principles – Iteration 2

The second iteration was implemented in the year following the first iteration. The intervention commenced at the beginning of the first Australian school term and continued for the duration of the school year. Eight of the original 12 members continued to participate in the ICT CoP and the six members who consented to participate in the data collection during Iteration 1 continued their consent to participate in Iteration 2. The data collection activities conducted during Iteration 2 were used to reflect on the success of the draft design principles and identify further potential refinements.

Technology steward’s reflections

Again, the participants’ interview responses and the field notes journal were used to reflect on the Collective efficacy learning framework’s implementation. Like the first iteration, the reflections recorded in the field notes journal concurred with those expressed by the participants interviewed in this study. The reflections identified access to online digital content and time to meet as potential areas of improvement.

A problem that frequently confronted teachers during Iteration 2 was the limited access to digital content. The teachers in this study required greater bandwidth to support all of the online activities they would have liked their students to utilise. Furthermore, the blocking of access to digital content reduced the teachers’ capacity to incorporate the websites they had become familiar with into their ICT practices’. These limitations caused great frustration as well as disruption to the teachers’ intention to utilise ICT for teaching and learning.

Increased workloads during Iteration 2 reduced the time teachers had available to participate in the ICT CoP. Subsequently, meeting to discuss practices relevant to the ICT CoP became a challenge for community members, as Heron College’s leadership began taking over the direction of the ICT CoP’s meetings by cancelling meetings and requesting teachers work on other College priorities. Having less time to participate in community activities and seeing the repurposing of community meeting times caused community members to feel despondent.
**Recommended improvements**

To identify potential refinements to the draft principles, insights from the participants, as well as my reflections on stewarding the ICT CoP, were mapped against each element of the *Collective efficacy learning framework*. The issues and recommendations that informed the final set of design principles are presented in Table 4.2.
### Table 4.2: Iteration 2 – Issues and recommendations

<table>
<thead>
<tr>
<th>Draft principles</th>
<th>Issues</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Facilitate an open dialogue between inside and outside perspectives.</td>
<td>Participants continued to find opportunities to discuss ICT practices in private spaces challenging. The forum remained underutilised. Much of the communication in private spaces occurred outside of school hours (at the end of the day). Withdrawal of support from the College’s leadership to hold and participate in public ICT CoP meeting. Lack of IT technical support from the College. Increased workload demands.</td>
<td>A key leader needs to be part of the community to maintain the strategic alignment between the CoP and the College’s learning aims.</td>
</tr>
<tr>
<td>2. Invite different levels of participation.</td>
<td>No issues identified.</td>
<td></td>
</tr>
<tr>
<td>3. Develop both public and private spaces for members to communicate.</td>
<td>Two meetings were cancelled at the request of the College’s leadership. Time and competing priorities were challenges to communication. The forum remained underutilised.</td>
<td>Regularly communicate to school leaders the significance of the learning outcomes and achievements derived from ICT CoP.</td>
</tr>
<tr>
<td>4. Promote the value of maintaining membership to the community.</td>
<td>Teachers developed a sense that their efforts were undervalued by the College’s leadership.</td>
<td>Regularly communicate to school leaders the significance of the learning outcomes and achievements derived from ICT CoP.</td>
</tr>
<tr>
<td>5. Provide learning experiences that promote the development of ICT capabilities and collective efficacy.</td>
<td>Teachers and students experienced Internet bandwidth limitations. The Internet filtering software prevented access to many educational websites. The teachers’ new laptops could not connect to classroom data projectors. Limited access to audio speakers. Limited planning time.</td>
<td>Build boundary-crosser relationships with the IT technicians.</td>
</tr>
<tr>
<td>6. Create a rhythm for the community members’ interactions.</td>
<td>One meeting was cancelled at the request of the College’s leadership. One showcase was repurposed by the College’s leadership. The direction of the ICT CoP was influenced by the school’s leadership</td>
<td>Regularly communicate to school leaders the learning outcomes and achievements derived from ICT CoP participation.</td>
</tr>
</tbody>
</table>
The recommendations listed in Table 4.2 were incorporated into the final review of the draft design principles and an additional principle was added. The additional principle is to ensure school leaders value the ICT CoP by understanding the community’s achievements and alignment with institutional priorities.

**Summary**

This chapter described how the learning environment was instantiated and the role of the researcher within this context. The chapter also described the participants’ learning journey through each iteration, and how the participants’ and my reflections were used to refine further instantiations of the *Collective efficacy learning framework*’s draft design principles. The next chapter will present a discussion of the data analysis.
Chapters 5 and 6 present an analysis of the data collected during Phase 3 of the study, to answer the research question:

In what ways can a professional learning framework, based on the principles of communities of practice, support the co-construction of collective efficacy beliefs and transform individual teaching practices in the implementation of information and communication technology?

Each chapter explores how contextual factors enhanced teachers’ ICT capabilities and influenced their co-construction of collective efficacy beliefs. Chapter 5 explores the teachers’ digital pedagogy and Chapter 6 the influence of direction-setting leadership practices. Each chapter is chronologically organised to reflect the intervention’s two iterative cycles. An overview of the data analysis is presented in Figure 5.1.

Learning is a complex process and how the teachers learn within the workplace depends on a larger system made up of embedded contexts. The embedded contexts influential in this study are represented in Figure 5.1. During the data analysis, it emerged that embedded contexts were significant in interpreting the data collected during Phase 3 of the design-based research approach. In Figure 5.1, the core categories are represented as concentric circles. At the centre of Figure 5.1 is the context of learning. Digital pedagogy and direction-setting leadership practices are represented by larger concentric circles. The embedded contexts imply that learning is influenced by digital pedagogy, which is in turn influenced by direction-setting leadership practices. Ultimately, the learners and their environment were interpreted to be part of the whole system.
The data analysis begins with a description of the teachers’ background use of educational technology before focusing on their digital pedagogy and co-construction of collective efficacy beliefs. When beginning to investigate the influence of a community of practice intervention that enhanced collective efficacy beliefs, it was useful to identify the teachers’ background uses of educational technology to help guide the ICT-capability-enhancing aims of the intervention.

**Background use of educational technology**

The teacher’s responses to the initial survey revealed that ICT was most frequently used to support direct instructional practices. The examples they provided included ICT being used as presentation tools, or using web-based video streaming services, such as YouTube. When students were directed to use educational technology, they accessed text documents or presentations stored on Heron College’s learning
management system (LMS) and external websites to research questions posed by their teachers. When working outside of the classroom, the teachers reported frequent use of email. Table 5.1 summarises each of the teachers’ background use of technology.

**Table 5.1: Teachers’ background use of ICT**

<table>
<thead>
<tr>
<th>Participant</th>
<th>Use of technology</th>
<th>Quote</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carol</td>
<td>Presentation tools</td>
<td>PowerPoint to emphasise main teaching points and allow students to communicate their research. Streaming news items that bring relevance to the theory taught in class (initial survey)</td>
</tr>
<tr>
<td>Jason</td>
<td>Presentation tools and access reference materials</td>
<td>Overhead projectors on a daily basis. Students use laptops to access texts and for some activities, phones as translator (initial survey)</td>
</tr>
<tr>
<td>Enoch</td>
<td>Presentation tools and administrative tasks</td>
<td>I use it for PowerPoint presentations, showing videos, creating worksheets and marking attendance (initial survey)</td>
</tr>
<tr>
<td>Melissa</td>
<td>Presentation tools and instructional technology</td>
<td>ICT is used extensively. Excel spreadsheets and interactive tutors. The traditional PowerPoint and Word applications are also extensively used (initial survey)</td>
</tr>
<tr>
<td>Sung-ho</td>
<td>Presentation tools and administrative tasks</td>
<td>I use technology for PowerPoint presentations e-mails, preparing worksheets, writing reports, keeping records, showing videos and showing YouTube clips (initial survey)</td>
</tr>
</tbody>
</table>

The teachers’ background use of educational technologies indicated that prior to the study they were predominantly using educational technology as a presentation tool to support teacher-centred methods of instruction, and students were directed to use educational technology to locate reference materials. As a result, presentation tools and search engine queries had replaced handwritten board-notes and visits to the school library. The teachers’ use of educational technology reflected a school-wide priority at Heron College to create digital repositories for students to access via the College’s LMS. In general, students and their families positively viewed teachers who created rich repositories of learning resources (Researcher, Field notes). Since PowerPoint presentations and YouTube videos had been available since 1990 and 2005 respectively, these digital resources had been available long enough for teachers to become competent in the use of these tools. Yet, how educators
structured learning experiences that included the use of ICT influenced the effectiveness of both teaching and learning experiences.

The research on student learning with educational technology has resoundingly concluded that the substitution of educational technology for so called “traditional” teaching practices made little or no significant difference to the educational gains of students (Kim & Reeves, 2007; Russell, 2010). The teachers in this study, who shared their background use of technology, provided little evidence to suggest that they regularly employed digital technologies in a way that supported effective teaching practices. The teachers’ dependence on presentation tools and Internet search engines reflected a more objectivist than constructivist pedagogy (Kinchin, Chadha, & Kokotailo, 2008), even though most teachers were aware constructivism is a theoretical philosophy that promises educational benefits for students. The obligation to provide students with an abundance of digital content, and the convenience of having easily recyclable teaching resources, led to the teachers in this study selecting educational technologies based on their ease of use over evidenced-based pedagogical practices. The technology use described in this section is an example of workplace learning where the teachers have effectively learned poor practices. Workplace learning that fosters poor work practices has been recognised in other fields, such as in the research conducted by Hodkinson (n.d.) in his examination of the learning culture of trainee nurses.

**First iteration: Digital pedagogy**

The provision of classroom-based learning experiences is the primary activity of most secondary school teachers. Therefore, it may have been foreseeable that teachers in this study reported the classroom context, the “regular and sustained interactions of students and teachers around subject matter” (Leonard-Barton, 1990, p. 203), as a significant influence on their decision to participate in the ICT CoP. It was digital pedagogy, the use of technology to facilitate learning experiences, that emerged as the core category representing the classroom-level factors that influenced teachers’ participation in the ICT CoP. The themes informing the digital pedagogy category were classroom management, ICT capability and technological pedagogical knowledge. These themes are explored in the following sections.
Classroom management

Classroom management included the strategies educators employed to reduce discipline problems and engage students in learning activities. During the first iteration, teachers reported using ICT to captivate and engage the attention of their students. For example, in the quote below, Jason described how he used educational technology to engage the interests of his students:

> Personally, I find that [in] lessons with students the entertainment value plays a part – a big part – in their learning process. They need to be a little bit entertained so that you can get their attention. I find that YouTube clips, if you can come up with something like that, you can build a lesson around it. Then their focus and attention will be better (Jason, Semi-structured interview 1).

In Jason’s example, he described using educational technology as an incentive to engage students in learning activities that they may have otherwise found mundane. Jason’s example highlights how many of the teachers at Heron College were employing educational technology as the “seductive details” (Garner et al., 1989) to entice students into learning. Sung-ho shared a reason why teachers might feel their students needed an element of enticement:

> If I really wanted to make a difference and if I really want to teach them something, I’m going to have to put it into a format that they find entertaining … And [it’s] on my mind that I am competing with this [motioning towards his mobile phone]. They have got a plethora of really wonderful stuff, and that is what I am competing with at the front of my classroom (Sung-ho, Semi-structured interview 1).

When Sung-ho described “a plethora of really wonderful stuff”, he was referring to the technology and multimedia available to students in their daily lives. Sung-ho believed that maintaining the interests of his students sometimes required educational experiences that could compete with the students’ recreational uses of technology and also matched the students’ expectation that education should be entertaining.

During the first iteration, teachers described how educational technology was transforming their teaching practices. ICT was being used to engage students in learning (classroom management) and as a result the teachers in this study noticed
the positive impact technology had on the on-task behaviours of their students. These on-task behaviours motivated teachers to more regularly use educational technology. The ICT CoP was successful in supporting teachers who wanted to integrate more ICT into their lessons. However, it had not significantly influenced the teachers’ digital pedagogies over the relatively short period of time the teacher had been participating in the community. Consequently, the types of low-level learning activities students were completing were likely to have made little difference to their educational outcomes when compared with more conventional modes of learning. At this stage, the teachers in this study had not been afforded enough time to reflect upon their ICT teaching practices and collectively negotiate the meaning of digital pedagogy in the context of Heron College. As the teachers increased the frequency with which they used educational technology, their ICT capability became a more meaningful learning focus during the study.

**ICT capability**

At the beginning of the first iteration, all teachers who took part in the study self-reported a deficiency in their individual ICT capabilities. This deficit was revealed in the teachers’ responses to questions about their initial motivation for taking part in the ICT CoP. Presented in Table 5.2 is a summary of each teacher’s primary motivation to participate in the ICT CoP.

<table>
<thead>
<tr>
<th>Participant</th>
<th>Motivation for participating in the ICT CoP</th>
<th>Quote</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carol</td>
<td>Differentiation tasks to support student learning</td>
<td>Software allows teachers to develop student-based tasks, which are flexible and allow students to learn at different rates (initial survey)</td>
</tr>
<tr>
<td>Jason</td>
<td>To improve competence when using ICT</td>
<td>To improve my own skill set (initial survey)</td>
</tr>
<tr>
<td>Enoch</td>
<td>To improve ICT competence and practices</td>
<td>To improve my IT skills and use the computers better with the students (initial survey)</td>
</tr>
<tr>
<td>Melissa</td>
<td>Keeping up-to-date with technology</td>
<td>It is the wave of the future. ICT must be embraced if we wish to move forward with the world of ideas (initial survey)</td>
</tr>
<tr>
<td>Sung-ho</td>
<td>Sung-ho was not available to participate in the first round of data collection</td>
<td></td>
</tr>
</tbody>
</table>

---

88
Fulfilling professional learning and development goals was a common driver that motivated teachers to participate in the ICT CoP. Prior to the implementation of the ICT CoP, few teachers in this study had engaged in ICT-related professional learning and development. This was perhaps due to the relatively recent development of these tools and to competing professional priorities, which are explored in more detail in Chapter 6. Nevertheless, the teachers embraced the opportunity to pursue their educational technology learning goals through the ICT CoP.

**Technological pedagogical knowledge**

A widely held goal for teachers in this study was improvement in teaching and learning processes through the integration of educational technology. This goal and the actions of teachers working towards achieving this goal has been categorised as *technological pedagogical knowledge* as it deals with:

An understanding of how teaching and learning can change when particular technologies are used in particular ways. This includes knowing the pedagogical affordances and constraints of a range of technological tools as they relate to disciplinarily and developmentally appropriate pedagogical designs and strategies (Koehler & Mishra, 2009).

A need for pedagogical improvement grew out of the increased presence of digital technology at Heron College as well as curriculum changes. These changes caused teachers to reflect on their teaching practices:

When I think about improving a lesson, I do think about how I can bring in the IT. I do that a lot more than I have ever done (Jason, Semi-structured interview).

Although the teachers in this study were well-meaning, much of their adoption of education technologies and their digital teaching practices remained uncritical during Iteration 1. During this time, the teachers continued to predominantly use ICT as a presentation tool, and students were expected to learn *from* technology instead of the more constructivist practice of learning *with* technology (Jonassen, Peck, & Wilson, 1999) where students actively construct knowledge through reflection and communication (Hiebert et al., 1997). Like Jason, the teachers believed that using the latest digital technologies led to better learning outcomes because the students appeared to be more engaged in the activity of learning from ICT. These
observations suggest that the teachers in this study were working at Schibeci et al.’s (2008) first stage of teacher ICT learning, Where’s the on button? This first stage is characterised by a focus on ICT skills, personal confidence and learning how to use technology. The teachers in this study were aware they needed to enhance their ICT capabilities and, at this stage, were learning how to create lessons that incorporated the use of technology. A focus on learning to use technology without considering the pedagogical effectiveness of the strategy also aligns with the first stage of professional development experienced for individuals who were still “mastering the technical aspects without direct concern with educational aspects” (Schibeci et al., 2008, p. 316).

**Digital pedagogy and co-construction of collective efficacy**

The teachers who participated in this study believed that digital technology was an important resource to support student learning. Chapter 1 presented background information describing how the teachers in this study began their learning trajectory with the widely held belief that ICT could support students’ educational outcomes and help them develop the necessary competencies required of 21st-century learners. The teachers initially judged the success of technology based on their students’ willingness to remain engaged in learning without distraction. However, with experience, some teachers came to the realisation that for meaningful learning to occur it required teachers to develop competency with their digital pedagogy. As the teachers participated in activities related to the ICT CoP, they focused on increasing their digital capabilities to deliver lessons that were more interesting for students. As they experimented with planning lessons that required students to use digital technologies, their estimations of the challenges presented by using ICT also decreased. In the following comment, Jason described his experience of increasing the use of ICT in his classroom:

> It’s just having the confidence to jump in and have a go, and then you realise it’s not as difficult as maybe you first thought it was (Jason, Semi-structured interview 1).

As the teachers increasingly incorporated ICT into their lessons and, in the process, learned about new ways of using ICT, they reported the self-perception of having the
ability to complete the task of implementing ICT learning experiences that supported students’ education.

The teachers’ experiences were shared with other community members during public and private meetings. For some community members, the discussions and negotiations of meaning that occurred during these discussions began to foster a shift in pedagogy from ICT as a classroom management tool to ICT as a tool to construct and share knowledge. At the end of Iteration 1, Jason provided an example of how discussion had helped him negotiate the meaning of ICT:

ICT was meant to be about communication, largely. When you sit around a table and talk about that, it does get you thinking (Jason, Semi-structured interview 1).

Subsequently, there is evidence that the community of practice was providing opportunities to co-construct meaning. The additional meaning now attributed to ICT was that it not only engaged students, but it was also a communication tool. This new meaning was reflected in teachers’ new professional learning and development goals:

Podcasts and screencasts. Those are the two tools I need to find time to work on. I am very enthusiastic. I am keen to know more (Carol, Semi-structured interview 1).

Podcasts and screencasts are two tools to deliver information and communicate understanding of content. However, goals like these could not always be realised due to Heron College’s ageing resources and the inability for these resources to match the teachers’ evolving needs. This issue is explored in Chapter 6.

During the first iteration, the teachers in this study encountered problems with accessing computers and peripheral devices when implementing lessons. When asked how effectively ICT had been used to facilitate student learning, Enoch replied:

Most people using it are using it as well as they can within the constraints that exist here (Enoch, Semi-structured interview 1).
The teachers appeared to believe that their ICT practices were limited by the facilities available at Heron College. In other words, the teaching task was perceived to be limited by the context. The teachers were not prevented from using ICT but held a view that the capacity to engage in the practice of using ICT was constrained by the resources available to them. This belief had to be limiting the teachers’ sources of collective efficacy information. Goddard et al.’s (2004) model of collective efficacy predicts that the sources of efficacy information (mastery experiences, vicarious experiences, social persuasion and affective states) influenced a teacher’s analysis of the task and the resources available to them. Despite the initial technological issues that at times interrupted lessons and the teachers’ professional learning and development goals, at the end of the first iteration the contextual limitations were not significant enough for teachers to report low or lowered estimations of collective efficacy beliefs – at least, not until the latter part of Iteration 2. Ultimately, the teachers participating in this study could see that members of the ICT CoP were collaborating, their efforts were perceived to be valued, and they valued participation in the ICT CoP, resulting in the co-construction of collective efficacy beliefs.

**Second iteration: Digital pedagogy**

After their initial attempts to enhance student learning, some teachers in this study began to critically examine their digital pedagogy and, as a result, they grew more aware of other institutional factors that influenced their ICT use. This section explores the influence of the teachers’ continued use of educational technology throughout the second iteration with a focus on the impact of a redirection in the leadership priorities at Heron College.

**Classroom management**

At the end of the second iteration, nearly two years after the ICT CoP commenced, some of the teachers maintained their view that educational technology provided the “seductive details” that helped to maintain students’ interest in learning. Jason provided an example of this view:

> You have something really boring, you think: well I’ll jazz that up with ICT (Jason, Semi-structure interview 2).
On the other hand, teachers like Carol noticed a difference when they compared the quality of students’ earlier and later engagement with ICT:

About two years ago, the students were more engaged because computers represented something new ... I think these days it takes a lot more than just creating a computer lesson for them to become engaged because they are used to the technology. It’s become like bringing a calculator into class. In order to continue motivating students, the activities have had to be more engaging (Carol, Semi-structured interview 2).

Carol’s comment described how the use of educational technology initially provided motivation for students to engage in learning experiences. However, over time, the novelty of learning from educational technology had waned. Subsequently, some teachers believed they had to find more appealing and novel ways to engage students in learning. As students became more familiar with using ICT it became less effective as a tool to manage the students’ engagement in learning and for achieving learning outcomes. In reaction to this, some teachers sought alternative ways to engage students in learning. One strategy used by the teachers, that served the dual purpose of adding an element of fun into the lesson and engagement in learning, was the introduction of educational games. In the quote below, Enoch reflects on the students’ response to learning with ICT and points out his experience with educational games:

I think they respond to these types of tasks now exactly the same way they would respond to any teacher-generated worksheet that you give them. Having said that, the use of games in the classroom can help engage and enhance the interest initially if used properly (Enoch, Semi-structured interview 2).

A secondary issue with the diminishing novelty of educational technology was activities that were once fun had become banal. Consequently, the novelty of using educational technology for learning that initially appeared to keep students on task gave way to distraction:

[Computers] are a major distraction for students! Teachers need to be very strong in that environment to make sure [students] are not being distracted by laptops and doing things they should not be doing with laptops. If you have a weak teacher who is not really monitoring them, then, of course, the whole unlimited access can be a disaster in terms of distraction for students. What it
does is place more emphasis on the teacher to control the environment. It does complicate the classroom-learning environment (Enoch, Semi-structured interview 2).

As the novelty of using ICT began to wane for students, the teachers began to reflect on the level of effort required to manage a class of students using computers, and the effectiveness of computers as a tool to engage students in learning. Reflection led to a more critical use of educational technology, but a focus on using ICT to manage students remained a priority for many teachers in this study.

**ICT capability**

The teachers in this study frequently referenced the Australian Curriculum as a factor driving their desire to improve their ICT capabilities during Iteration 2. As outlined in Chapter 2, the Australian Curriculum requires teachers to incorporate digital technology into each learning area (ACARA, 2018a). This was much more technology than teachers were required to use in the previous Curriculum Framework (Western Australia Curriculum Council, 1998):

> The curriculum changes have required us to adopt more ICT in the learning of the subject, so that has been a significant factor (Carol, Semi-structured interview 2).

The curriculum changes Carol described were introduced through the Australian Curriculum’s (ACARA, 2018a) general capability *Information and Communication Technology Capability*. To address this requirement, teachers are required to help students “learn to use ICT effectively and appropriately access, create and communicate information and ideas, solve problems and work collaboratively in learning areas at school and in their lives beyond school” (ACARA, 2018b para. 1).

Other teachers reported similar experiences to Carol’s increased use of educational technology when teaching lower secondary classes. However, the increased use of educational technology in the lower secondary classes was not reflected in the senior secondary classes:

> [In] WACE courses, we don’t have room or time for that. That’s why I don’t have it in my senior school classes. But in the middle school classes, you
have that ability to play around and just have fun with it (Sung-ho, Semi-structured interview 2).

Sung-ho described how the teachers of upper secondary courses were resistant to increasing the amount of educational technology, and the perception that learning with educational technologies took up valuable preparation and classroom time. They generally felt that the more conventional teaching methods were the most efficient way to cover the requisite learning objectives – thus indicating that the teachers in this study held sceptical views about their existing ICT practices and the potential of ICT as a learning tool. Nevertheless, from their participation in the ICT CoP, the teachers had increased their ICT capabilities and had become more adept at meeting the technology requirements of the new curriculum.

At the end of the study, some teachers reported a sense of being able to facilitate improved learning outcomes when their students used educational technology:

I think that when you do manipulatives using ICT the learning takes place at a faster rate (Sung-ho, Semi-structured interview 2).

A virtual or “digital manipulative” (Resnick, 1998) is “an interactive web-based visual representation of a dynamic object that presents opportunities for constructing mathematical knowledge” (Moyer, Bolyard, & Spikell, 2002). Sung-ho provided an example of how he employed a more constructivist digital pedagogy during the second iteration, and through his engagement in the ICT CoP he had concluded that effective learning experiences can be achieved through the use of ICT. Not all teachers reached this conclusion at the end of the study.

On the other hand, other teachers reported no substantial difference in learning when students used educational technologies:

It has been two years, and I think it’s been pretty effective in terms of I have been able to adopt some of the programs we teach to reflect more of what they would learn manually in the real world. In a sense, they are able to get the same benefit from using a computer program as they would if doing it manually (Carol, Semi-structured interview 2).
At the end of the second iteration all teachers had made progress towards fulfilling the Australian Curriculum’s requirement to incorporate digital technology into learning for students studying the lower secondary curriculum. Furthermore, some teachers’ digital pedagogies were beginning to support a more constructivist learning approach.

**Resources**

During the second intervention, the digital systems were noticeably ageing, and fewer financial resources were being dedicated to the maintenance of the available technologies. As a result, the Internet access and computing facilities were not as open or as well maintained as they had been during the first iteration. In the quote below, Carol shared how the decline in quality of digital systems available to students influenced their receptiveness to using ICT:

> They will give up if it doesn’t work the first time and take the cynical approach of it didn’t work: “This is crap; the school is crap”. It is easy for them to get a negative mindset rather than persevere and try (Carol, Semi-structured interview 2).

At the beginning of this study, I observed an increase in the adoption of ICT by teachers and students at Heron College. Later I noted that, within in the final six months of the second iteration, the frequency of technology use declined to its original levels before the study began (Researcher, Field notes). The reason for the decline was due to the increased number of challenges encountered by teachers wishing to use ICT. These were greater than those previously encountered. The technology was ageing and not being replaced; therefore, teachers could not rely on all of the laptops working when they booked a class set for students. Furthermore, access to online resources had been reduced. Yet, despite the challenges encountered by teachers, they continued to persist in implementing occasional lessons that required students to use ICT. Partly for this reason, teachers became effective at modifying a lesson when ICT was not working as originally planned:

> Equipment malfunctions, I’ve had enough of those now to know that there is a plan B. I know that if the projector is not working or if the globe has just blown or if the machine’s shut down or if the power is not there or you’ve left your toggle somewhere else. You know you make do with what you got what you have so but is not a perfect world I don’t get anxious about those things
any more I’m very comfortable walking into a room having prepared obviously for a lesson and perhaps understanding that things might not go as planned (Carol, Semi-structured interview 1).

Carol’s quote demonstrated how, despite the occasional challenge, the teachers’ desire to use ICT in the classroom remained positive. Nevertheless, the challenges were deterring from the teachers’ ability to use ICT. Consequently, there was less of a need to participate in the ICT CoP if the digital technologies were not user-friendly or easily accessible.

Although the Heron College strategic plan advocated for the use of ICT by teachers and students, the College’s leadership decided to restrict Internet access and reduce the Internet bandwidth available to teachers and students. These restrictions resulted in the blocking of websites frequently used by teachers, slower access to websites and a negative response from the teachers:

When you have shut down things like you have in the last couple of days, you have just turned off a lot of very excited teachers (Sung-ho, Semi-structured interview 2).

Sung-ho’s remark about “shut down things”, is a reference to the restrictions placed on the College’s Internet access.

As time passed the resources became cumbersome due to ageing and a lack of maintenance. ICT had reached a critical point whereby the College technologies had become challenging to use. Part of the problem was that the leadership group did not have an adequate asset maintenance and replacement program despite having an in-house IT department.

Heron College’s leadership had provided enough resources for the teachers to increase or maintain their self-efficacy beliefs surrounding their use of ICT. However, teachers’ judgments about the task requirements to carry out the practice of implementing lessons that employed the use of ICT was negatively impacted by the leadership’s ICT resourcing. The finding in this section confirms Goddard and Hoy’s (2004) claim that the development of collective efficacy beliefs are informed by the teachers’ analysis of the teaching task and their assessment of teaching
competence. While it was revealed that the teachers’ assessments of teaching competence were supported by the ICT CoP, the teachers’ analysis of the teaching task was limited by the leadership’s control of resourcing.

**Digital pedagogy and the co-construction of collective efficacy**

The teachers’ level of satisfaction lowered during the second iteration and resulted in the co-construction of collective efficacy beliefs for using ICT being subdued. The available ICT resources limited the learning activities teachers could use to engage their students, and also prevented teachers from achieving their ICT learning goals. As a result, the teachers concluded that the task of using ICT at Heron College was not always possible.

**Summary**

The aim of the data analysis discussed in this chapter was to examine how a professional learning and development intervention enhanced teachers’ ICT capabilities. It emerged that the effectiveness of the *Collective efficacy learning framework*’s draft design principles were inextricably linked to the contexts of Heron College’s environment. This chapter identified *digital pedagogy* as a significant influence on the teachers: the co-construction of meaning, the self-direction of their professional learning and development, and their cultivation of efficacious beliefs.

Through their participation in the ICT CoP, the teachers revealed that the meaning they attributed to ICT practices changed over time. Initially, ICT was used as a classroom management tool to engage students in learning. Over time, the teachers’ reflective practices and socially shared cognitions led to them co-constructing the notion that ICT should be used as a cognitive tool for students to communicate the knowledge they have constructed. The co-construction of new meaning for ICT practices influenced the goals of the teachers’ professional learning and development.

Participation in the ICT CoP supported self-directed learning. The teachers in this study were able to reflect on their learning goals and align them with the meanings they attributed to ICT practices. After becoming aware of the significance of using
ICT as a cognitive tool, some teachers aligned their learning goals with developing the ICT capabilities to create digital multimedia.

During Iteration 1, the teachers had enough time and access to digital resources to enhance their ICT capabilities. Time provided teachers with opportunities to engage in learning and enactive mastery through planning and implementing ICT practices. It also provided the opportunity for communicating with peers to learn, problem-solve, negotiate meaning, vicariously experience each other’s practices, and verbally persuade one another. Having both time and resources allowed teachers to analyse the task of implementing ICT practices as being achievable, and supported the co-construction of collective efficacious beliefs. Unfortunately, during Iteration 2, collective efficacy beliefs were negatively impacted by a lack of time and dysfunctional resources. A lack of time reduced the teachers’ engagement in learning and implementation of ICT practices and the dysfunctional resources limited the time teachers dedicated to ICT mastery and learning experiences.

The following data analysis chapter continues the examination of how the professional learning and development intervention enhanced teachers’ ICT capabilities with a focus on the school administration context.
Chapter 6: Data Analysis – Direction-Setting Leadership Practices

This chapter continues the data analysis with an exploration of direction-setting leadership practices, a term coined by Sun and Leithwood (2015) to describe leadership practices that develop shared goals or establish a vision. As in Chapter 5, the data collected during Phase 3 of the design-based research were analysed to answer the research question:

In what ways can a professional learning framework, based on the principles of communities of practice, support the co-construction of collective efficacy beliefs and transform individual teaching practices in the implementation of information and communication technology?

The previous chapter described the core category represented by digital pedagogy. These classroom-level factors were not independent of the school system; they were supported or inhibited by a variety of prevailing factors beyond the classroom level. Direction-setting leadership practices emerged as the category to describe the school administrative context, which can be defined as the “system policies, resources and structures” (Leonard-Barton, 1990, p. 204) that inevitably mediated significant aspects of digital pedagogy through the leadership’s influence on the technology resources, teaching conditions and school climate at Heron College. These three factors were found to significantly influence the teachers’ co-construction of efficacy beliefs and subsequently impact ICT teaching practices.

The technology resources referred to in this chapter include computers, mobile devices, applications, interactive whiteboards, data projectors, audio speakers and the Internet. Although they have many applications, all of these devices were purposed as educational technologies during this study. Teaching conditions represent variables such as administrative support, physical assets, technology availability, participative decision-making (Probst, 2005), and access to professional learning and
development. In this study, *school climate* describes workplace relationships, organisational priorities, teaching and learning focuses, and the institutional norms of the research site.

The legitimacy of this research was influenced by the institutional priorities held by school leaders at Heron College. Accordingly, if the ICT CoP was to hold a legitimate status at Heron College then the aims of the ICT CoP would have needed to align with the College’s strategic plan. Thus, before exploring *teaching conditions, school climate* and *technology resources* it is important to discuss the legitimacy of this research by situating it within the institutional priorities of Heron College.

**Legitimate role**

From the beginning, the ICT CoP performed a legitimate role at Heron College. A comparison between the strategic plan of Heron College and the aims of the ICT CoP confirmed that there existed an alignment between the two entities’ priorities. Table 6.1 provides a comparison of the strategic plan and the ICT CoP.
Table 6.1: Comparison of the School’s strategic plan and the aims of the ICT Community of Practice

<table>
<thead>
<tr>
<th>School’s strategic plan</th>
<th>Aims of the ICT Community of Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Professional learning and development</strong></td>
<td>The School’s strategic plan described how individual teachers would “undergo continuous professional development and learning… Ensure ICT skills are integrated into the curriculum” (Heron College strategic plan).</td>
</tr>
<tr>
<td><strong>Learning community</strong></td>
<td>The school had aspirations to encourage teachers to participate in learning communities by stating that a “professional learning communities philosophy introduced [sic]” (Heron College strategic plan).</td>
</tr>
<tr>
<td><strong>Collective efficacy</strong></td>
<td>The initiative to “develop a culture of one staff” (Heron College strategic plan) described how the leadership wanted to support a collective culture between the staff at the school.</td>
</tr>
</tbody>
</table>

A strategic alignment, such as the one between the ICT CoP and the Heron College strategic plan, is described by Wenger et al. (2002) as being significant in gaining legitimacy and influence within an organisation. Even though communities of practice have a slightly different emphasis to the professional learning community referenced in Heron College’s strategic plan, the difference is insignificant in this situation. The school leaders at Heron College sought to leverage the collective capabilities of their teachers for professional learning and development as opposed to being wed to one specific learning theory. From the outset, the ICT CoP held a legitimate role at Heron College.

Missing from the Heron College strategic plan were details on how educational technology should be employed at the College. This omission provided an opportunity for teachers to negotiate their own technology practices, reified through their ICT practices in the classroom. On the surface, the unspecified use of
educational technology seemed to provide opportunities for the teachers to provide feedback and influence the direction of ICT use at the College.

The remainder of this chapter explores how direction-setting leadership practices influenced the teachers’ development of ICT capabilities and co-construction of efficacy beliefs.

**First iteration**

Through an analysis of the data collected during the first iteration, the following sections explore how the direction-setting leadership practices influenced teaching conditions, school climate and technology resources.

**Teaching conditions**

Time constraints and competing priorities were the two conditions that most significantly influenced the teachers’ ability to participate in the ICT CoP. Direction-setting leadership practices ultimately placed constraints on the teachers’ time and resulted in teachers needing to carefully prioritise between competing workplace demands. The negative influence of these two factors is significant, as without the social co-participation of community members the learning aims of the community of practice could not be accomplished. Attention will now be turned to exploring the impact of time constraints and competing priorities on professional learning and development and the construction of efficacy beliefs.

A sense of being time-poor was a perception that influenced the teachers’ ability to participate in the ICT CoP. For example, when Jason was questioned about how he and a colleague had progressed with their creation of an ICT-enriched task for students he replied:

I haven’t even talked about it, to be honest. We barely have time to talk (Jason, Semi-structured interview 1).

Other teachers echoed Jason’s experience of struggling with time constraints that prevented engagement in community-related activities. To explain why this had occurred, Carol shared her insight into the activities that teachers perceived to be consuming their valuable time:
Teachers are generally time poor. More could be done if teachers were freed up from the endless co-curricular and administrative demands of their daily duties (Carol, Semi-structured interview 1).

In addition to fulfilling the requirements of a full-time teaching load, teachers at Heron College were required to participate in an additional two-hours of co-curricular sport or recreational activity and attend 90 minutes of weekly meetings. Thus, teachers had to carefully prioritise their engagement in work when not teaching students.

In describing the challenges associated with balancing the teachers’ work demands with participation in the community of practice, Jason remarked about his limited involvement in the ICT CoP:

If it isn’t done, there isn’t a consequence. So that’s why it ends up down the priority list (Jason, Semi-structured interview 1).

Ultimately, the teachers’ busy work schedule made it challenging for them to dedicate time to activities that were not immediate or urgent, such as engagement in the ICT CoP. Recognising the challenge teachers faced, the College’s Principal provided time for the ICT CoP to meet during student-free staff development days, and also organised for the community of practice members to have time away from their teaching duties to meet together:

Thanks to [co-facilitator] and Stuart for being our two facilitators. This is a great opportunity for our staff to connect with ways to use our ICT facilities to enhance teaching. This was very difficult to achieve with minimal disruption (Principal, Internal email correspondence).

Having this additional time release greatly helped the ICT CoP members commit to working towards the community’s aims. Still, outside of these dedicated meeting times, busy schedules influenced the amount of communication and learning shared between members. For instance, Jason described how the shared perception that all teachers were busy influenced the frequency of community interactions outside of the formally organised meeting times:
Quite often I find, especially, [with] something like [the] marksbook, I find that I’ve got a problem and I don’t know who to ask because I am very reluctant to come straight to yourself or Sung-ho because you’re just as busy (Jason, Semi-structured interview 1).

The ICT CoP members Jason referred to in his quote were the two core members. Limited opportunity for community members to communicate had the potential to undermine learning as a sociocultural process. Social interactions form the foundations of a community of practice. Therefore, restricted opportunities to communicate limited the sharing of knowledge, negotiation of meaning, reification of ICT practices, development of identity, and opportunities to develop efficacious beliefs through vicarious learning and verbal persuasion. Nevertheless, the assistance provided by the Principal in the form of time to engage in community activities allowed the teachers sufficient time to engage in the ICT CoP during the first iteration.

**Technology resources**

Teaching with educational technology required access to digital devices; subsequently, the resources available to teachers and students at Heron College influenced the types of activities they could engage in. The Principal and Business Manager tightly controlled the selection and purchasing of educational technologies used by teachers and students. Due to the autocratic leadership culture (Harms, Wood, Landay, Lester, & Lester, 2018) at Heron College, the teachers had little to no influence on or opportunity to participate in technology-related decision-making. Nevertheless, a range of investments had been made by the College leadership prior to the study. Accordingly, teachers had access to interactive whiteboards, laptop computers, multimedia projects and the Internet. For some teachers, this was an adequate range of technology. However, other teachers complained that technology was often unwieldy or incompatible with their mobile devices.

Having access to the World Wide Web was at times necessary to support the planned learning activities of students. However, the teachers and students did not always have access to satisfactory levels of Internet bandwidth, and this proved to be an issue. Melissa described her feelings about planning lessons that relied on Heron College’s Internet access:
I’m not going to put a lot of energy into that because I may be frustrated. You fall down, and you tend to lose your persistence. We are all experiencing the same problems (Melissa, Semi-structured interview 1).

Melissa’s comment describes how the slow Internet speeds at Heron College could reduce both the teachers’ and students’ ability to utilise the Internet to access digital content. During the first iteration, the Internet speeds slowed after the College’s leadership allowed all students to connect their personal mobile devices to the College’s Wi-Fi. The action of allowing students nearly unfettered access to the Internet provided such a drain on the College’s network that educational websites were inaccessible at times. Issues with Internet access became such an issue that it reduced the effort teachers were willing to dedicate towards using online educational resources. While this action was off-putting for some teachers, others were motivated to seek ways to work around the College’s Internet limitations. Describing how he worked around Internet limitations Sung-ho shared:

Like the kids, I have been using my phone because at least I can access things that way (Sung-ho, Semi-structured Interview 1).

Sung-ho described how he began using his personal mobile phone data to circumvent the College’s Internet access. In addition to slow Internet speeds, the teachers reported issues with a lack of access to peripheral devices:

Not having speakers in the room is a major issue for me. They’re such a cheap item for every room to have (Jason, Semi-structured interview 1).

Not having audio speakers in the classroom also became a significant issue for another of the community’s members’:

Battle of the speakers! I call it battle of the speakers because I might as well buy my own (Sung-ho, Semi-structured interview 1).

A lack of access to audio speakers prevented teachers from sharing digital content with students that contained audio. Before teachers could present multimedia to their students, they had to connect their laptop computers to the College’s peripheral devices. This also proved to be an issue for some.
A number of teachers found the digital resources at Heron College incompatible with their teacher laptop computers. Compounding this issue was the leadership’s refusal to purchase compatible accessories to connect the teachers’ laptop computers to classroom multimedia projectors:

Like [the] dongle Kathy bought, I went and said this [item] should be provided if you want us to use IT (Sung-ho, Semi-structured interview 1).

The dongle that Sung-ho referred to was an adaptor cable to connect the teacher’s laptop computer to the College’s roof-mounted data projectors. At the beginning of the first iteration, the school refused to purchase speakers and audio-visual adaptors for the teachers. Teachers who did not purchase their own audio-visual adaptors experienced a lack of connectivity to classroom data projectors and peripheral devices, thus limiting the presentation of digital media to students. As a result, many teachers had to reduce their reliance on ICT until the resourcing of technology and filtering issues could better support their use of technology. Less technology use lessened opportunities for teachers to participate in mastery experiences that could have cultivated their efficacious beliefs.

**School climate**

School climate represents an array of factors that can influence a teacher’s experiences of the workplace. This category included the “shared beliefs, values, and attitudes that shape interactions between the students, teachers, and administrators” (Mitchell, Bradshaw, & Leaf, 2010). Significantly, direction-setting leadership practices have a moderately strong influence on school climate (Sun & Leithwood, 2015). The themes identified as being significant to this category were antecedents, power relations, principal support and peer relations beyond the community of practice. As the school climate has an element of historic context this section will begin with an exploration of the antecedents.

**Antecedents**

Historically, Heron College had experienced a climate of embracing educational technology. Carol, a long-serving member of the school community, recounted her experience of this climate during her first interview:
When we joined the College [during the inaugural year], it was promoted as an ICT school that was going to provide facilities for students to use computers in the classroom. Even teachers were encouraged to use it as much as possible (Carol, Semi-structured interview 1).

Heron College was purposely designed to support a technology-rich learning environment. Most of the middle school classrooms were adjacent to small computer labs and the areas were separated by glass partitions so teachers could easily monitor students in both rooms simultaneously. The College contained a lecture theatre with state-of-the-art presentation technology, computers lined the library, and purpose-built enclaves housed rows of computers in the corridors of each building. Interestingly, the school was an early adopter of LMS technology. The longest-serving teachers, like Carol, fondly remembered a time when the technology use could be described as a climate of early adoption of innovations (Rogers, 2010). At the time of this research, the early adoptive climate of the past had given way to a climate of late adopters, laggards (Rogers, 2010). Overall, those teachers who experienced the more positive climate of the past conveyed more cynicism about their present predicament than did teachers who had joined the College in more recent years.

**Power**

The teachers who participated in this study reported that their ability to influence decisions at the school was limited. What they did describe was their attitude towards their personal sense of power (Anderson, John, & Keltner, 2012). Scholars have defined personal sense of power as the “capacity to control and influence others or resources” (Kim, Lee, & Rua, 2015, p. 599). When Melissa was asked if members of the ICT CoP had the capacity to influence decisions or change at the school she replied:

> I have to say no. I don’t feel as though consultation occurs and it just feels like a fait accompli (Melissa, Semi-structured interview 1).

Melissa’s comment reflected a generally held belief that teachers were not included in the decision-making processes at Heron College. Even if teachers were able to provide input on an issue, the general feeling was that the College’s leaders had already decided on a preferred outcome before teachers were engaged in any
decision-making process. Feelings of disempowerment created a culture where teachers were less likely to raise issues:

Maybe we need to be more vocal and try and exert pressure. I’m obviously just thinking about these whiteboards. There must be other things that could be easily changed [to] make the technology more useful (Jason, Semi-structured interview 1).

Members of the ICT CoP perceived themselves to be powerless in influencing institutional decisions, even if a situation was preventing them from completing their work effectively. There seemed to be little negotiation between the teachers and the leadership. Feelings of powerlessness were a cultural norm at Heron College and a desire to acquire greater digital capabilities at the College reinforced this belief.

The teachers desired newer resources to support student learning; in spite of that, they found the College’s leadership reluctant to fulfil the teacher’s resourcing requests:

There’s a lot more that could happen, but it’s a matter of doing two things. One, being brave enough to put your requests in for budgeting purposes. With the hope that it doesn’t get knocked back. But then it’s always been a [frugal] culture. So, one tends not to ask for stuff (Carol, Semi-structured interview 1).

Carol shared how a culture of denying teachers’ requests for resources had intensified feelings of being disempowered from decision-making processes. In particular, the teachers felt powerless to influence decisions controlled by the Business Manager. Consequently, at the end of the first iteration, the semi-structured interview included questions about the power relationships at Heron College. During the interviews, some teachers were reluctant to pass comment on the power relations that existed at the College. Therefore, this line of questioning was not pursued. Based on the evidence, I hypothesised that the teachers felt intimidated by the authority wielded by the College’s Business Manager. Fortunately, the Principal was sympathetic to the aims of the ICT CoP.
**Principal's influence**

The teachers in this study were reluctant to comment on the College leadership during the interviews. As a consequence, the data analysis for this section is limited. Nevertheless, the College Principal played a large part in influencing the school climate, so the significance of this theme justifies an exploration using the available data.

Although a limited data set was evaluated, Melissa shared an anecdote about how the teachers viewed the Principal:

> It seems quite a positive feeling from leadership. In [the Principal’s] typical fashion [he is] very grateful that people are willing to try and squeeze [professional learning and development] into their day (Melissa, Semi-structured interview 1).

The Principal was supportive of the ICT CoP and the teachers were of the opinion that he was aware of the teachers’ work demands. The Principal’s support was occasionally publicly demonstrated:

> Dear All Staff

> Professional Development: Thank you Sung-ho and Stuart

> The involvement of all staff in whole school professional development is required and vital. Today was a special day with two outstanding professional development activities being conducted.

> Firstly, the important ICT session was superbly facilitated by Sung-ho and Stuart. A highlight of the program is its practical nature where teachers are required to be creative with ICT and apply this in classrooms. The necessity to work in teams is a key characteristic (Principal, Internal email correspondence).

However, he was perceived as having a somewhat limited scope of influence by both the staff and by his own admissions. For example, during the last school term of the first iteration, the Principal reported arriving at the school on the first day of the term to find:
A new IT manager has been employed at the school without the Principal’s knowledge (Researcher, Field notes).

Even though the scope of the Principal’s influence was more limited than most school principals he was viewed as being supportive of the teachers’ engagement in the ICT CoP.

**Brokering**

The IT technicians who worked at Heron College during the first iteration played a significant role in brokering. Brokering is the process whereby a community member transfers the practices of one community and integrates these practices to another community (Wenger, 1998). The original IT technicians took the time to involve themselves in the activities of the ICT CoP and brokered technical knowledge about implementing ICT practices. From the teacher’s perspective, Melissa described her experiences with the College’s IT technicians:

> Well [the IT staff] are a massive resource. I owe them so much chocolate. I know they’re IT support, but sometimes I think some of the questions I am going to ask them about is a waste of their time, in a way. They must have a lot of other things, more technical things to do. I need a help desk for dummies, so I am not wasting the expert’s time. That’s how I feel. So, I am very apologetic every time I go down there, but they are good at helping (Melissa, Semi-structured interview 1).

During the first iteration, the teachers felt supported by Heron College’s IT technicians. The teachers found the IT department supportive of their requests, even if the teachers thought that their needs were wasting the technician’s time. This changed at the end of the first iteration, when the leadership changed the IT personnel employed at College. The ramifications of this change are explored later in this chapter within the discussion on Iteration 2.

**Rewards and recognition**

Rewards and recognition represent two means of motivating employees. Participation in the ICT CoP was accompanied by its own rewards and recognition. Melissa articulated the intrinsic rewards experienced by teachers participating in the ICT CoP when she described the reward she received from community participation:
Intrinsic joy of sharing and learning I think, definitely. I think Sung-ho does too. I hope he gets a buzz out of when he shows someone how to use something. When I learnt how to use AirDrop, I was so excited about it! It’s great! It makes me feel good. It saves me time in a way that time is the reward as well (Melissa, Semi-structured interview 1).

Teacher rewards came from the intrinsic rewards they derived from learning and a sense of increased confidence in their capacity to organise learning experiences that utilised ICT. The ICT CoP was initiated in response to a need for teachers to improve their ICT practices. Moreover, it was not expected that the teachers participating in the ICT CoP would receive tangible rewards from Heron College for participating in the ICT CoP. Nevertheless, the school’s leadership promoted the teachers’ engagement in this form of professional engagement and required all teachers to participate in technology-based professional learning and development as part of Heron College’s strategic plan.

**Direction-setting leadership practices and collective efficacy beliefs**

Most members of the ICT CoP were long-serving teachers at Heron College. A decade prior to the research, these teachers had been the early adopters of innovative educational technologies, but now they were acutely aware that they were the laggards. This late adoption of technology innovations was partly caused by a leadership who dismissed the teachers’ request for resources and, over time, the experience left teachers feeling powerless. Adding to the feeling of powerlessness was a Principal who had limited scope to govern the school and support teachers.

The teachers appeared to believe that their ICT practices were limited by the *direction-setting leadership practices* at Heron College. The leadership practices did not prevent teachers from implementing ICT in the classroom but constrained the resources available to them. Fortunately, at the end of the first iteration, the contextual limitations were not significant enough for teachers to report low estimations of collective efficacy beliefs.

**Second iteration**

Through an analysis of the data collected during the second iteration, the remainder of this chapter continues to explore how the *direction-setting leadership practices* influenced *teaching conditions, school climate* and *technology resources*. During this
time, the teachers began to feel their status and contributions had become undervalued. Yet, sometimes, the data collected presented a conservative view of teachers’ experiences due to fears of redundancy for those who spoke frankly and openly. As a result, care was taken not to ask teachers to share views that would have compromised their status at the College. For this reason, incorporated into the data analysis are more of my journal, reflections and research site artefacts. In interpreting my notes, utmost care was taken to locate myself as a scholar and present each observation through a theoretical lens. The following section begins with an analysis of the teaching conditions.

**Teaching conditions**

During the second iteration, teachers at the research site reported changes to their work conditions that competed for their time to plan ICT learning experiences:

> In our department, there has been a push to use websites like Nrich and Maths On-line. Again, time and planning have limited our use. To organise a productive lesson, you actually need time to plan. A lot of teachers plan in their own time because we are doing marking and other things (Sung-ho, Semi-structured interview 2).

Sung-ho’s comment mentioned the goal of increasing the use of online educational resources and depicted a situation where the teachers’ workloads had prevented them from implementing educational technology-based learning activities. Sung-ho listed “marking and other things”, as activities that consumed the teachers’ preparation time. One of the “other things” that detracted from the teachers’ preparation time was a requirement to take teacher relief lessons:

> Dear Staff,

> It is an expectation of the College that all teaching staff are available to do relief when required.

> A full-time staff member can be expected to do up to 20 additional unpaid periods per 10-week term. A pro-rata number of periods is expected from part-time staff (for example a 0.6FTE staff member could be expected to cover up to an additional 12 periods in a 10-week term) (Internal relief expectations, Internal email correspondence).
Historically, there had always been a requirement for teachers at Heron College to accept the occasional request to replace absent teachers during their duties other than teaching (DOTT) time. Yet, the reduction in DOTT time caused teachers to focus more on essential and urgent matters and less on non-immediate activities like professional learning and development:

Potentially, it was great. We just had no time. [Another participant] and I spoke about it, and we would give each other guilty kind of, “have you?”, “No, have you?””, “no”. Neither of us could commit time because we knew it was too far down the list of priorities (Jason, Semi-Structured interview 2).

In many activities, novice practitioners lack domain expertise and require more time to complete tasks than expert practitioners. Subsequently, less experienced teachers required more time to integrate educational technology into their lessons than expert teachers. Without adequate planning time, the novice teachers who were “developing a sense of capabilities and significance of particular ICT” (Schibeci et al., 2008, p. 316) resorted to direct instructional teaching practices or used technology as a substitute for answering questions from textbooks. The combination of teachers being time poor and having to place a low priority on participating in the ICT CoP provided a challenge to creating a rhythm for the community. When Jason was asked if he felt a rhythm for community engagement had been achieved, he succinctly commented:

No, because it kept getting cancelled (Jason, Semi-structured interview 2).

To fulfill school-level priorities, teachers were required to align their professional priorities with school leader (institutional-level) priorities. At times, it seemed that the school leaders’ priorities were at odds with the teachers’ professional learning and development priorities. The incongruence between teachers’ professional learning and development goals and the institutional goals only emerged as an issue during the second iteration.

Each year, Heron College held a two-day ‘in-house’ conference. During the conference, teachers attended presentations and workshops on various aspects of their professional practice and participated in “wellbeing” workshops. The wellbeing
workshops were run by volunteer teachers and included a range of recreational activities such as knitting, cooking and drawing, while the College’s leadership organised the education-related presentations and workshops, such as Myers Briggs testing, child protection information sessions and staff expectations. During these conference days the ICT CoP was allotted time for the members to meet and showcase their practices. However, on the first day of one conference, the Principal announced the technology showcase would be cancelled and the time would be repurposed to discuss the school’s technology needs:

On the first day of the conference, I had requested time for the community to get together. This meeting was cancelled at the request of the Principal and replaced with a meeting to discuss how the school’s ICT community, IT department and administration could get together to discuss how the recent unhappiness with the school’s ICT infrastructure could be resolved by encouraging a united vision and understanding of each other’s needs (Researcher, Field notes).

As one of the attendees of this meeting, I recalled that the focus of the meeting was to convince teachers that the restrictions placed on Internet access were necessary. Unfortunately, there was less focus on soliciting feedback from the teachers.

The Principal’s cancellation of the showcase provided a reason for teachers to question the level of support they were offered and the significance of the ICT CoP. The following quote represents Sung-ho’s evaluation of the teachers’ feelings after the Principal repurposed the ICT CoP’s showcase:

That really drained the enthusiasm (Sung-ho Semi-structured interview 2).

While there was never an expectation that the school would make special accommodations for the ICT CoP, missing out on scheduled opportunities to meet face-to-face placed pressure on the community members to find alternate ways to engage with each other. Effectively, teachers needed to choose between ICT CoP participation and work priorities. The reduced time to participate in ICT CoP-related activities influenced the school climate for the participants. Teachers viewed the College’s leadership as being responsible for working conditions that limited their time to participate in the ICT CoP:
The lack of time to prep didn’t really send a message. Or sent a message to us that it is not important. We did not get time to meet or plan (Sung-ho, Semi-structured interview 2).

The lack of available time was draining the teachers’ enthusiasm for participating in the ICT CoP. Competing priorities such as lesson planning and marking students’ work were given higher priorities. Furthermore, there was not enough time for teachers to observe each other’s classroom ICT practices. These factors reduced learning opportunities and opportunities to participate in activities that could provide sources of collective efficacy beliefs.

**Technology resources**

Interviews conducted during the second iteration explored how Heron College’s ICT infrastructure influenced the teachers’ use of education technology. The resulting data analysis revealed a general level of dissatisfaction with the digital resources provided by the College at that time. The College’s digital technologies were ageing, and less financial resourcing had been dedicated to the maintenance of these resources. It was discovered that the teachers’ dissatisfaction influenced both their use of ICT and their participation in the ICT CoP. The effect of digital resourcing on the teachers’ agency is detailed in the following section, beginning with an exploration of access to digital content.

**Access to digital content**

In response to the misuse of digital technology, the College imposed strict web filtering to control content teachers and students could access via the Internet. The reason cited for limiting access to digital content was due to inappropriate use of social media:

Dear All Teaching Staff

Cyberspace, whether it be accessed by Facebook, Twitter or any other social medium is part of the workplace over which an employer is entitled to exercise control. That control extends past the actual workplace and traditional work hours. It is standard practice and I would assume a professional understanding that any interaction between teachers, students and parents of employees who may potentially be critical, offensive or threatening towards their workplace generally potentially is misconduct.
I am disturbed that Facebook has been used by teaching staff in a manner that is critical and offensive to Heron College at this time (Principal, Internal email correspondence).

Many teachers found the restricted access to online content provided an unwanted challenge to providing students with ICT-enriched learning experiences:

A hindrance for me would be if I need to go to a particular website. I may trial [a webpage] at home, which may be blocked when I get to school (Sung-ho, Semi-structured interview 2).

Inadequate access to educational websites resulted in some lessons not proceeding as originally planned. Furthermore, the web filtering software interfered with the utility of the mobile devices students were required to bring to school.

The College limited students’ access to websites by installing web-filtering software on the students’ laptop computers. The filtering software installed itself onto the students’ laptops as they logged into Heron College’s Wi-Fi service. However, the software limited content students could access both at school and at home, and software was installed regardless of whether or not the laptop computers were the student’s personal devices or leased from the school. Once installed the monitoring software restricted access to social media, video-sharing websites, file sharing websites and any search engines that also provided email accounts such as Google and Yahoo. To avoid the installation of web filtering software on their computers a number of students began leaving their laptop computers at home. The number of students leaving their laptop computers at home was significant enough to disrupt technology-based learning activities. Furthermore, the web filtering extended to blocking teachers’ access to video-sharing websites such as YouTube and TeacherTube.

Teachers viewed the College’s web filtering protocols as a draconian measure. This led many teachers to sympathise with the students’ frustrations, and some even encouraged students to actively protest against the strict Internet filtering. When the students did begin to protest, it became a significant event at the College. The ramifications of this protest are explored in a later section of this chapter, within the context of power relations.
In addition to issues surrounding the accessing of web pages, Internet bandwidth limitations frequently prevented access to digitally rich content. Enoch shared his experiences with bandwidth issues:

> Factors you have to consider here is whether or not the Internet is going to be working at a fast-enough rate to make the lesson worthwhile. For example, earlier this year I found a really good interactive timeline of the Arab Spring, BBC website. The Internet we had simply wasn’t good enough to run that activity (Enoch, Semi-structured interview 2).

The teachers in this study valued the role of ICT in student learning; therefore, a few technologically savvy teachers found ways to circumvent the Internet limitations imposed by the College. During a discussion about the inadequacies of the Internet access, Enoch shared how he circumvented the College’s bandwidth limitations:

> I can’t even use Google Maps. Google Maps won’t load. When you are a SOSE teacher, you are doing geography, and you’re teaching about the cultures in other countries. I cannot show them a map. I have got two gigs on my phone. I should have just turned it into a hot spot and just used that (Enoch, Semi-structured Interview 2).

During another discussion with Enoch, he revealed that:

> To overcome limitations with Internet access he had asked a student to download video on their personal mobile device so the video could be shared with the class (Researcher, Field notes).

Complaints about Internet access were openly shared between teachers and students. As a result of the restrictions, students also began to share the teachers’ feeling of cynicism towards the school’s technological infrastructure:

> The problem is that students become very cynical of the use of a particular strategy when they can’t have access to the online portal or it’s down or systems fail in some way and students are a little bit less resilient than adults (Carol, Semi-structured interview 2).

Although some teachers found ways to circumvent the College’s web filtering software, the limited Internet access only facilitated the use of presentation media. The effect of imposing strict limits to one of the most commonly relied upon
educational technologies led to most of the teachers feeling frustrated and directed blame for the situation towards an external locus of control:

The problem is that you run into those issues not because of how good or bad your lessons are but because of external issues that are there (Carol, Semi-structured interview 2).

During the second iteration, limited access to the wealth of online digital resources became an issue for teachers. Many educationally appropriate resources were blocked and even when teachers were able to access high-quality, media-rich resources the College’s bandwidth was not large enough to handle the content. These two issues fuelled a high level of scepticism in the utility of the College’s technology infrastructure and caused participation in the ICT CoP during this time to become a low priority. Less use of technology resulted in fewer learning experiences and fewer sources of collective efficacy beliefs.

Eventually, late in the second iteration, some relaxing of Internet restrictions transpired as a result of complaints from disgruntled staff, students and parents:

I had a great meeting with the IT technicians last week to see how they are travelling the world of ICT.

A key issue that was discussed was YouTube filtering. They have sent a detailed email on the current position with YouTube. Thank you to them for working very quickly to try and put a solution in place that satisfies teachers’ needs. They have put in place a system that allows YouTube access in class time but is not accessible outside class teaching time for students (Principal, Internal email correspondence).

Nevertheless, many teachers remained unhappy with the Principal’s solution:

They have sent me a password and username that they are going to be revealing to all teachers. This is fine, but it is not a solution … By the time I plug in the password and username, and I view one [page] and then I want to go to view another I have to start plugging it in again. It’s not time-effective. We are going back to the dark ages! (Sung-ho, Semi-structured Interview 1)
As result of all of the technology challenges, teachers resorted to using technology in ways that were familiar to them, proved to be reliable, were easy to implement, and had the potential to decrease lesson preparation time:

I’m using IT to mostly present materials rather than using the whiteboard for everything. I very, very rarely use the whiteboard. I am using the projector to do a number of things: to give information, to use images to spark interest, discussion questions, samples of student’s work [and] model students work (Enoch, Semi-structured interview 2).

While it allowed teachers the opportunity to integrate ICT into students’ learning activities, this conservative use of educational technology helped teachers avoid becoming frustrated.

The teachers had become weary of the Internet limitations and lack of digital resources. The teachers resorted to using technology in traditional tried and tested ways that would result in them encountering the least number of barriers. The sense of frustration experienced by the teachers somewhat lessened the value of participating in the ICT CoP. The teachers felt restricted in their application of and access to educational technology, and the challenges teachers faced were blamed on an external locus of control. Apart from limited access to the Internet, access to working resources was also an issue.

Ageing infrastructure

In the years prior to the study, Heron College had invested in a wide range of digital technologies. However, some teachers found the presence of old educational technologies had limited teaching practices whether they were using the technology or not:

I’m a fan of the interactive whiteboard, but I don’t use it as an interactive whiteboard. I use it as a projector to my screen. Which frustrates me. I miss not being able to just use a plain whiteboard I can actually write on with whiteboard markers and erase because you can’t write on any of these boards. So is interesting when I requested [that] these boards be taken away and have our whiteboards in front of the projector screen. We were told no. Which is odd if we can’t actually use them (Melissa, Semi-structured interview 2).
The issue of outdated technology was not isolated to Melissa’s classroom. A quarter of the College’s classrooms contained interactive whiteboards, yet none were used interactively during the two-year study.

An effective management of educational technology would be to adopt new technologies with features that support the needs of the teachers and students whilst removing the ineffective resources (Bansemir, 2013). The effective life of a new computer is accepted to be four years (Australian Tax Office, 2018). After this time, ICT hardware can become incompatible with newer software, it can struggle to manage operating system demands, and computer companies produce fewer replacement parts. Due to the College’s resistance to investing in new technology and concerns about teacher and student access to non-educationally relevant digital content, at times the available digital resources were viewed as an encumbrance that inhibited the teacher’s work in the classroom. Nevertheless, the teachers remained optimistic about the potential for ICT to support educational practices. Ultimately, some of the limitations of ageing digital technology detracted from the teachers’ participation in the ICT CoP.

Despite the leadership’s poor management of digital resourcing, the teachers continued to persist in implementing ICT-enhanced learning. To these ends, when the technology was working as planned, the teachers experienced a sense of improving the students’ engagement and learning. Throughout the study, the teachers desire to cultivate their digital pedagogy remained positive. Nevertheless, the numerous challenges had detracted from the teachers’ ability to use educational technology. Consequently, there was less motivation to participate in the ICT CoP if the digital technologies were not user-friendly or easily accessible.

**School climate**

The second iteration provided an opportunity to explore the construct of school climate in greater depth. The analysis of Heron College’s climate revealed three themes: enterprise agreement negotiations, IT support, professional learning and development and technology resources, which were significant factors influencing school climate. Responses to the questions about school climate described both the organisational culture and the organisational climate. Denison’s (1996) definition of
school climate as the “internal social psychological relationship of that environment to individual meaning and organisational adaptation” (p. 625) is a useful one for the purposes of this study. School climate was explored in more detail during the second iteration, as I needed to build trust with the participants before they felt comfortable enough to share their candid views on the school climate at Heron College. Nevertheless, not all teachers were comfortable talking about school climate. Carol asked if she could conduct the interview off campus because she wanted to ensure her views remained confidential, as she wanted to speak candidly about her experiences. Sung-ho asked to share what he felt was relevant but did not want any questions asked of him on the topic of school culture. Accordingly, I respected the participants’ requests and ensured they were not placed in any situations where they would have felt uncomfortable.

**Enterprise agreement negotiations**

The enterprise bargaining agreement (EBA) negotiations negatively influenced the teachers’ satisfaction with their employer. Consequently, I deemed the events surrounding the EBA negotiation sufficient enough to include an exploration of this event in the data analysis.

Negotiations on the teachers’ EBA coincided with the second iteration. The way teachers felt they were being treated by Heron College’s leadership created negative feelings among the teachers whenever someone broached the subject. The teachers’ EBA had expired, and they had attempted to enter into negotiation with the help of their union. After four months of working on the negotiations, the teachers’ union informed its members that a draft agreement had been submitted to Heron College, yet the College’s Business Manager claimed the draft EBA had not been received. Without an agreement to present to the College board, the approval process could not occur. When eventually the Business Manager did acknowledge receipt of the draft EBA, it could not be presented to the board as all board positions were up for re-election:

The delay was viewed by teachers as intentional and fuelled a significant level of distrust in the College’s leadership (Researcher, Field notes).
It should be noted that many teachers felt the Principal was not as accountable as the Business Manager, as he had little influence over these matters. Without word on how the EBA process was proceeding, six months into negotiations, the teachers collectively sent a letter to the Business Manager seeking closure on the EBA negotiations. An excerpt from the letter is quoted below:

> We also discussed at the meeting the position/mood of staff at the moment, and the following was noted:
> - Staff are beginning to feel undervalued;
> - It has been 18 months since our last pay rise and many people are struggling financially;
> - Fear that due to low student numbers/pay increases there won’t be jobs next year, so we need to know asap in order to have the opportunity to apply for the best jobs as they start to be advertised from Term Three (Email communication from the EBA committee).

The letter is significant as it documented the teachers’ feelings of dissatisfaction and job insecurity. The teachers’ claim of dissatisfaction and job insecurity was in contrast to the message conveyed by the College in their Annual report for the same time period. The report states that:

> The average score for teacher satisfaction (morale) in the College was 78 on a scale from 0 to 100 where 100 is the best possible score (Heron College annual report).

The EBA negotiations created feelings of unhappiness and distrust. These emotions work against the development of collective efficacy, especially because a positive effect correlates to increases in efficacious beliefs (Bandura, 1997). To compound issues, during this period teachers felt they were no longer supported by the College’s IT support technicians.

**Brokering**

After the inappropriate use of digital technology (described earlier in this chapter), the two teachers involved in the matter had their employment terminated.
Furthermore, the IT Manager was demoted and the IT technician who bridged the boundary between the IT department and the ICT Community of Practice’s employment was also terminated. At the time of this study, the new IT manager was not embedded in the social fabric of the school due to their recent arrival at Heron College. These changes in personnel created a division between teachers in this study and the College’s IT support technicians:

You need IT people who get off their ass and come to you. You know, it is like you go into IT, it is like a little kingdom. They are nice guys but let’s face it if we were objective about the efficiency of their role it’s bullshit (Enoch, Semi-structured interview 2).

Enoch’s quote provides insight into the level of frustration felt by members of the ICT CoP after a significant person who crossed the boundary between teacher and IT technician was removed from the community. Furthermore, it supports the significance of having a draft design principle that promoted the sharing of outsider perspectives with the ICT CoP. Without the boundary crosser, the teachers felt they were not effectively supported, and this added another dimension to the teachers’ sceptical beliefs about the level of support provided by the College’s leadership.

The changes in IT personnel resulted in a new work climate that provided less support than the outgoing IT technicians provided for members of the ICT CoP, largely because the changes removed a significant knowledge broker. Sung-ho shared his thoughts on the impact of changing the IT personnel.

At least back then there you could go and talk to them [the original ICT Technicians]. I never go in there anymore. The door is always shut. It is not just metaphorically shut it is physically shut. Whereas, before it wasn’t. You could go in there, now you feel it is a bit like “Why are you here?” (Sung-ho, Semi-structured interview 2)

Sung-ho’s quote illustrates a contrast in the teacher’s experiences from the first iteration when they had a knowledge broker who shared knowledge from beyond the boundaries of the ICT CoP, to the second iteration where the absence of the broker created feelings of not being able to access a satisfactory level of technical expertise.
The IT knowledge brokers provided technical support for teachers who wanted to incorporate ICT into their lessons. The College’s decision to replace the IT technicians reduced learning opportunities for members of the ICT CoP. Removal of the boundary crosser also contributed to the feelings of disempowerment that teachers experienced during the second iteration.

**Power**

The data analysis from Iteration 2 revealed that the teachers who participated in this study continued to feel powerless to influence the institutional level practices at Heron College. The experience of powerlessness did not abate from Iteration 1. Some teachers saw an opportunity to leverage the students’ frustrations with the College’s Internet service and encouraged them to protest because the teachers’ voices alone lacked the power to influence change. Sung-ho shared that he became so frustrated with the perceived draconian limitations imposed on the College’s Internet access for both staff and students that he incited the Year 12 students’ protest against the school:

> Sung-ho encouraged his Year 12 students to complain about the ICT situation at the school. As a result, a few of the student leaders created a petition and many signatories requesting that the school relax the Internet filtering policies and stop blocking students from social media sites when they are using their own devices at home (Researcher, Field notes).

Eventually, an acceptable level of Internet access was restored for both the students and the teaching staff. The restoration was the result of a student petition and complaints from staff and parents.

Effort, persistence and resilience result from a teacher’s sense of self-efficacy. According to Goddard et al.’s (2004) model of the formation of collective efficacy beliefs, these beliefs inform teachers’ judgements about collective efficacy beliefs. The teachers’ perceived lack of power inhibited the formation of their collective efficacy beliefs because they believed they could not influence the resourcing of the college enabling them to acquire the tools required to implement ICT-enhanced learning experiences.
Rewards and recognition

During her interview, Carol echoed the teachers’ opinion that positive praise was not enough recognition of the teachers’ efforts. The teachers in this study did acknowledge there was a great deal of positive recognition from the school’s Principal celebrating their participation in the ICT CoP; however, this praise had become a platitude. The teachers wanted recognition for their efforts to be demonstrated in ways that would directly affect their ability to manage their participation in the ICT CoP or provide financial rewards. By Iteration 2, some teachers felt less intrinsically motivated and more extrinsically motivated:

I think the best positive feedback and praise you can get is it is built into your pay. I know it is coming from a business background but, you know, if this is something that administrators would want to see happen in a serious way there would be some sort of financial reward or time reward built into it. But positive feedback as saying well done for doing that has its merits, but I don’t think that at the end of the day, how important? I don’t think that it will be terribly important not in my opinion anyway (Carol, Semi-Structured interview 2).

From the inception of the ICT CoP there were no rewards on offer other than intrinsic rewards. A reason for the teachers’ shift in motivation from intrinsic to extrinsic rewards was not explored in the data analysis but it corresponded to declining working conditions for the teachers at Heron College. Perhaps some teachers forgot that that we voluntarily initiated the community, and the close alignment between the aims of the ICT CoP and the College strategic plan lead teachers to believe that they had an entitlement to financial rewards for their efforts. Regardless, the impact of desiring an extrinsic reward over an intrinsic reward is an indication that the positive affect teachers were feeling towards ICT and the ICT CoP was decreasing and the teachers perceived that they had more efficacious capacity than the context of Heron College allowed them to enact. When the context limited the teacher’s efficacious expression it impacted the teacher’s motivation, shifting it to one of entitlement. This finding is significant as an affective state informs how teachers analyse, attribute and interpret their assessment of competence and the task analysis when forming judgments about collective efficacy (Goddard et al., 2004).
Professional learning and development

When the leaders of Heron College coordinated professional learning and development, it provided an avenue to collectively focus the teachers’ efforts on working towards the strategic intentions of the College. By the same token, coordinated professional learning and development provided an opportunity to build the collective capacity of teachers. For Heron College, the annual staff conference was the main event used by the College’s leaders to coordinate professional learning and development at a school level.

I attended the conference held during the second iteration and noted that all of the professional learning and development sessions were either on the topic of ICT or literacy and each session was delivered as a presentation. One might have predicted at the outset of the conference, an attempt to focus on ICT would have been embraced by the ICT CoP members but the reaction from them was quite the opposite. When describing the outcomes of participating in one of the ICT sessions Melissa describes her feelings toward the learning experience as a:

… waste of time. I don’t remember anything. I remember sitting there going if I had the time to sit down with [other community members] we might get something done (Melissa, Semi-Structured interview 2).

The negativity expressed by Melissa was derived from the nature of the delivery, and the learning needs of the ICT CoP members had largely surpassed what was being delivered. Consequently, a one-size-fits-all approach to professional development did not meet the needs of the individual teachers. Furthermore, Enoch described his perception of the College’s efforts as being:

Everything’s ad hoc, everything’s piecemeal. Everything’s half-assed. There is no coordinated, structured program of ICT PD that has been monitored by somebody in admin. There’s no sequential stages to it. It’s just oh we need to fill an hour here on a PD day, let’s get IT to talk about something. There is zero, zero planning from admin regarding IT PD (Enoch, Semi-structured interview 2).
A climate of being out of touch with the teachers’ learning needs and a general feeling of not having the support needed to successfully participate in professional learning and development permeated the ICT CoP during Iteration 2.

Each teacher in this study was asked if they would repeat the experience of participating in the ICT CoP. Carol’s response captured the widespread reluctance to participate in the future of the ICT CoP under the College’s current conditions:

Not in my current environment, no. But if I was in a different school where they had priorities. If the administration of the school were serious about it, then I would certainly repeat the process because I think that it is worthwhile, valuable and I think in a different school environment I think it would probably work well. That’s my honest opinion (Carol, Semi-structured interview 2).

Carol’s quote alludes to the significant role school leaders play in supporting the learning aims of teachers. Professional learning and development were listed as a priority in Heron College’s strategic plan. On the surface, the College’s leadership supported professional learning and development; however, it did not engage in activities that supported the teachers’ participation. Nevertheless, the participants described the ICT CoP as a model for positively supporting professional learning and development.

While exploring the draft principles with Melissa, she summarised her thoughts on the supportiveness of learning based on these principles:

I think it is definitely the way to go (Melissa, Semi-structured interview 2).

The school leaders did not have a clear vision of how technology should be used at Heron College. Subsequently, the professional development opportunities they provided did not address the teachers’ learning needs. When professional learning and development was organised for the teaching staff, the opportunities appeared to be ad hoc and at times irrelevant. Nevertheless, the participants concurred that the draft design principles guiding the community of practice approach to learning were an effective way of engaging in professional learning and development for ICT.
**Direction-setting leadership practices and collective efficacy beliefs**

Throughout Heron College’s short history, it experienced fluctuations in the levels of ICT use. During this study, high levels of engagement were present when the College’s leadership prioritised and demonstrated support for the use of digital technologies, and lower levels of engagement resulted when digital technology became a lower leadership priority. The lower priority resulted from less strategic and financial investment in digital technologies at Heron College and reduced time available for teachers to participate in the ICT CoP. The fluctuations in the direction-setting leadership practices impacted upon the teachers’ efficacious beliefs.

During the second iteration, digital technology no longer remained a priority for the College’s leadership. A lower operational and financial investment in digital technology use resulted in reduced technical support for teachers. Seemingly insurmountable barriers to educational technology use were imposed on the teachers when the College leadership did not effectively support digital technology use. The teachers’ frustration with the technology and the College’s leadership grew during the second iteration. A lack of leadership support, increased workloads and ageing technology created a climate of dysfunction and a sense of ambivalence. At the end of the study, teachers at the research site wanted to implement more ICT practices; nevertheless, the lack of investment in ICT resources, lack of time to participate in the community activities, and removal of the knowledge brokers stifled the co-construction of collective efficacy beliefs.

**Summary**

The aim of the data analysis discussed in this chapter was to examine how a professional learning and development intervention enhanced teachers’ ICT capabilities. The data analysis from this chapter supported Chapter 5’s assertion that the effectiveness of the Collective efficacy learning framework’s draft design principles were inextricably linked to contexts of the school environment. This chapter identified direction-setting leadership priorities as being a significant influence on the technology resources, teaching conditions, and school climate.
The leadership’s control over technology resources was reported by teachers as being a significant encumbrance. The teachers’ agency to implement ICT practices was inhibited by outdated educational technologies and limited opportunities to access online digital content. The teachers in this study had the competence to implement more ICT practices than they were able to execute due to a lack of resources. The teachers viewed the technological limitation to be beyond their locus of control due to feeling a of powerlessness and the limitations of the resources available to them. The teachers’ perceptions of these limitations resulted in an analysis of the teaching task that lowered the teachers’ estimations of collective efficacy beliefs at the conclusion of Iteration 2.

Perceptions of an external locus of control that impeded ICT practices extended to decision making. At Heron College, teachers were unable to influence “instructionally relevant school decisions” (Goddard et al., 2004, p. 10). The teachers in this study reported feeling powerless to influence organisational change that would have improved the implementation of ICT practices. A culture of accepting that teachers had little power over institutional decision-making resulted in low estimations of the teachers’ personal sense of power and contributed to reflections that lowered the teacher’s estimations of collective efficacy beliefs.

The lack of digital technologies, a personal sense of powerlessness, the removal of knowledge brokers and stalled enterprise bargaining agreement negotiations fuelled a negative school climate at Heron College. Overall, the leadership did not provide enabling school structures that supported the teachers’ professional learning and development. In this study, the lack of enabling school structures reduced the amount of effort teachers were willing to dedicate to engaging with the ICT CoP and it created negative feelings towards the use of ICT. It is well established that negative feelings of affect can negatively impact the co-construction of collective efficacy beliefs (Bandura, 1997).
Chapter 7: Conclusion and Implications

This chapter presents a synopsis of the design-based research study presented in this thesis. The study involved the development, implementation and evaluation of a professional learning and development intervention for secondary school teachers for the purpose of enhancing ICT capabilities. Following the synopsis, the findings are discussed, and final design principles are presented. Next, the limitations of the research and recommendations for future research are outlined.

Overview of the study

The research project at the centre of this thesis was a learning environment designed to enhance teachers’ ICT capabilities through their participation in a community of practice intervention. As the learning environment was aimed at group-level activities, collective efficacy beliefs were also supported to promote organisational agency. The aim of this research project was to identify how contextual factors influenced teachers’ participation in a community of practice and to examine the factors that supported the co-construction of collective efficacy beliefs.

There are many reasons teachers create student learning experiences that incorporate the use of ICT. These reasons include enriching student learning (Scott, 2015), adhering to government policy (Education and Health Standing Committee, 2012), the emergence of new technology to make learning more interesting (Cox et al., 1999) and using ICTs as cognitive tools (Wang et al., 2014). However, the challenge facing the educational sector is that many teachers do not have the requisite knowledge and skills to take advantage of the affordances of educational technologies. Fortunately, the published literature has demonstrated that teachers can develop the required level of ICT capability through their engagement in professional learning and development (Annetta et al., 2013; Schibeci et al., 2008). Professional learning and development that aims to improve teachers’ ICT capabilities is most effective when learning is situated in the context of the teachers’ work and meets the teachers’ professional needs (Ministerial Council for Education...
Employment Training and Youth Affairs, 2005, p. 10). Furthermore, the development of “professional learning communities appears to hold considerable promise for capacity building for sustainable improvement” (Stoll et al., 2006, p. 221), including the improvement of teachers’ ICT capabilities.

Fortunately, a great deal of research evidence supported a communities of practice approach to professional learning and development (Lave & Wenger, 1991; Wenger, 2010; Wenger et al., 2002) that situates workplace learning in the context of the learners’ work practices. To incorporate beliefs within the community of practice framework, the concept of collective efficacy is used to connect teachers’ learning in the community and their practice. Furthermore, the agency for teachers to participate in professional learning, and integrate learning into their ICT practices is greatly influenced by efficacious beliefs (Bandura, 1997, 2001). Efficacy beliefs can be constructed at the individual level (self-efficacy) and at the group level (collective efficacy). Collective efficacy beliefs are an emergent, group-level attribute that can influence organisational agency (Hoy et al., 2002) and group-level performance (Bandura, 1993, 1997; Myers et al., 2004). This includes communities of practice members.

A design-based research approach guided the development and testing of the draft design principles that addressed the issue of enhancing teachers’ ICT capabilities. The design-based research process and how it was represented in this study is summarised in Figure 7.1.
The draft design principles were developed through a review of the literature on teacher professional learning and efficacy, and in consultation with the practitioners working at the research site. The guiding conceptual framework, from which the draft design principles were derived, was based on Wenger’s (2010) learning architecture and Goddard, Hoy and Hoy’s (2000, 2004) model of teacher collective efficacy. The resulting draft design principles were designed to enhance teachers’ ICT capabilities through professional learning and the cultivation of collective efficacy beliefs.

The product of this research is a contribution to the professional learning and collective efficacy literature, along with the creation of the Collective efficacy learning framework that can be implemented by teachers and school administrators who wish to enhance the ICT capabilities of their teachers. The Collective efficacy learning framework consists of seven principles designed to enhance learning and collective efficacy beliefs by supporting learners to disseminate the knowledge held by a few individuals, encourage the construction of new knowledge from outside an organisation, and generate new knowledge about ICT practices. Much of this knowledge acquisition is accomplished through leveraging individual expertise and supporting the development of collective efficacy beliefs. The research findings and final design principles are discussed in the following section.
Research question and findings

Research question

Chapters 5 and 6 discussed the research findings to answer the research question:

In what ways can a professional learning framework, based on the principles of communities of practice, support the co-construction of collective efficacy beliefs and transform individual teaching practices in the implementation of information and communication technology?

Broadly, the findings suggested that the communities of practice intervention did not exist in isolation from the broader sociocultural contexts within Heron College, it was quite the opposite. The intervention was intertwined with a host of sociocultural influences from a range of school contexts that impacted the outcome of the teachers’ participation in the intervention. These sociocultural influences have been identified by Wertsch (1991) as the social contexts and cultural tools that influence the development of beliefs, values and actions. A number of conclusions can be drawn from the findings of this study.

During the first iteration, teachers participated in the communities of practice intervention and reported increased collective efficacy beliefs – similar to Voelkel and Chrispeels’ (2017) study, which found participating in professional learning enhanced teachers’ collective efficacy beliefs. Unlike Voelkel and Chrispeels’ study, the enhanced collective efficacy beliefs were not sustained. One could go as far to say that collective inefficacy beliefs were constructed. The findings revealed that during the second iteration, limited time to engage in professional learning and development and not having access to resources were limiting factors in the co-construction of efficacious beliefs and enhancement of teachers’ ICT capabilities. Without adequate time to engage in professional learning and development, learning could not eventuate. Without adequate digital resources, the enactive mastery of ICT practices could not occur. The lack of time and resources caused teachers to reflect on the task of implementing ICT practices (task analysis) and conclude that, ultimately, they did not have the capacity to successfully participate in the ICT CoP.
to enhance their ICT capabilities (collective inefficacy). These findings show a similar relationship to the previous findings by Gray (2016), in that school structures can impact collective efficacy and in turn the overall school effectiveness. Gray (2016) found that enabling school structures positively impacted teachers’ collective efficacy. Whereas, the findings in this research are different in that the findings indicate that school structures can lead to collective inefficacy and negatively influence organisational agency. Two further conclusions can be drawn from these findings. Firstly, time and resources are elements of school enabling structures that need to be supported when teachers are participating in communities of practice. Secondly, when time and resources are perceived as being inadequate for professional learning and development, they can negatively influence teachers’ collective efficacy beliefs.

The teachers in this study participated in joint enterprise (Wenger, 1998) when the negotiation of meaning resulted in the evolution of their learning goals. At the beginning of the intervention, a common goal for teachers was to use ICT to engage students in learning. Upon learning about the applications of ICT and matching these to their students’ needs, the teachers began to change their learning goals from engaging students to using technology as a cognitive tool. The teachers’ learning impacted their goal setting to address deficits in their knowledge of presentation media and subsequently the ICT practices occurring in the classroom. The teachers’ learning goals were influenced by both the needs of their students and the negotiation of meaning that resulted from their participation in the ICT CoP.

Direction-setting leadership priorities were found to be a significant influence on the enhancement of ICT capabilities and co-construction of collective efficacy beliefs. When the direction-setting leadership priorities were aligned with the aims of the ICT CoP, the community achieved its goals supported via enabling school structures. However, it was challenging for learning to flourish and collective efficacy beliefs to grow when the direction-setting leadership priorities were not aligned with the aims of the ICT CoP, and the College’s leadership did not support the following enabling school structures:

- adequately manage resources,
• support teacher participation in relevant professional learning and development,
• provide adequate rewards, and
• create opportunities for decision making.

The lack of enabling school structures created a climate of distrust in the College’s leadership.

Providing empowering school structures through including the teachers’ voices in decision making is significant, as the “collective power to produce desired results is a key ingredient of collective agency” (Bandura, 2000, p. 75). Consequently, this is a tale of caution urging school leaders to support teachers in overcoming contextual challenges, as the person–context relations are significant to the process of learning (Walker, Pressick-Kilborn, Arnold, & Sainsbury, 2004).

The title of this thesis is Building ICT capacity by design: A community of practice approach for teacher professional development. The term “capacity” was carefully chosen because it encapsulated the themes that emerged from the pursuit of enhancing teachers’ ICT capabilities. Stoll et al. (2006) described capacity as “a complex blend of motivation, skill, positive learning, organisational conditions and culture, and infrastructure of support” (p. 221). The conclusions above go some way to addressing Takahashi’s (2010) and Wenger’s (1998) claim that there is a lack of attention to the “role of implicit negotiations of meaning” (p. 735), which could be limiting an understanding of how efficacy beliefs develop and, in this instance, influence the enhancement of ICT practices.

**Design principles**

The draft Collective efficacy learning framework provided a set of guidelines for enhancing teachers’ ICT capabilities. During testing of the framework, it was identified that an additional principle needed to be incorporated into the framework to ensure the community of practice will remain viable once implemented. The original guiding conceptual framework, presented in Figure 2.1, was revised and renamed the Sociocultural model of collective efficacy beliefs from community of practice participation to represent the broader sociocultural exchanges that could not be reconciled by the original guiding conceptual framework and the confines of this
research to the communities of practice framework. Furthermore, some of the original labels were removed for brevity.

The original guiding framework reflected the sociocultural exchanges that influence communities of practice members as they engaged in learning. However, the sociocultural exchanges that influenced the analysis of task and assessment of competence did not represent the social, cultural and physical contexts that were inseparable from community participation and the enactment of ICT practices. The revised guiding framework is presented in Figure 7.2.

![Figure 7.2: Sociocultural model of collective efficacy beliefs from community of practice participation](image)

In the revised framework, the sociocultural exchanges are represented by the largest rectangle and all of the other elements are embedded constructs. The single headed arrows represent the strongest direction of influence, while the two headed arrows reflect a bidirectional influence. Accordingly, participation in the community of practice results in the construction of learning, meaning and identity, which provides a source of collective efficacy information. The efficacy information is interpreted in light of the task and abilities of the social group, and an estimation of collective efficacy is co-constructed. The estimations of collective efficacy beliefs then influence the actions individuals engage in, and the results of these actions feed back into the sources of collective efficacy beliefs and analysis of the group’s ability to succeed.
The original six draft design principles that informed the *Collective efficacy learning framework* have been revised to a more succinct form, as recommended by Bakker (2019). An additional principle has been added, as it was identified in the findings and supported in the literature that school leaders need to “be participating in the professional development themselves, so that schools better understand the conditions that will sustain teachers’ ongoing learning” (Timperley, 2008a, para. 6). The revised *Collective efficacy learning framework* design principles are as follows:

- Facilitating an open dialogue between inside and outside perspectives on ICT use in education.
- Inviting different levels of participation from the participants.
- Developing both public and private community spaces for the members to communicate that provide opportunities to enhance ICT capabilities and self- and collective efficacy beliefs.
- Promoting the value of maintaining membership of the community.
- Providing the community with learning experiences that promote the development of ICT capacity and collective efficacy.
- Creating a rhythm for the community members’ interactions.
- Involving a representative of the school’s leadership regularly and peripherally in the community’s activities.

The above design principles are a framework that can be adapted to the context of an educational site seeking to enhance the ICT capabilities and collective efficacy beliefs of their teachers. For those seeking to implement the *Collective efficacy learning framework*, the heuristic statements of Van den Akker (2013) provide advice on the implementation of design principles:

“If you want to design [an intervention to the ICT capabilities of teachers within the context of their workplace] then you are best advised to give that intervention the characteristics [outlined in table 7.1] and to do that via the procedures also [suggested in Table 7.1] because of the theoretical argument [presented in Chapter 2] and the empirical argument [presented in Chapters 5 and 6]” (Van den Akker, 2013, p. 67).
Table 7.1 outlines the design principles and examples of how the principles can be instantiated in the learning environment.

**Table 7.1: Collective efficacy learning framework**

<table>
<thead>
<tr>
<th>Design principles</th>
<th>Example instantiation of principles in the learning environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Facilitating an open dialogue between inside and outside perspectives on ICT use in education</td>
<td>Invite members of other communities to join community events and share their knowledge/experiences. Send emissaries to other organisations on fact-finding missions and have them report back to the community. Provide opportunities for peripheral participants to learn from core members’ knowledge/skills. Provide opportunities for core members to share their knowledge with peripheral participants.</td>
</tr>
<tr>
<td>2. Inviting different levels of participation from the participants</td>
<td>Provide closed online forums to facilitate asynchronous discussions. Organise common meeting times to share knowledge and problem-solve.</td>
</tr>
<tr>
<td>3. Developing both public and private community spaces for the members to communicate that provide opportunities to enhance ICT capabilities and self- and collective efficacy beliefs.</td>
<td>Provide closed online forums to facilitate asynchronous discussions. Organise common meeting times to share knowledge and problem-solve.</td>
</tr>
<tr>
<td>4. Promoting the value of maintaining membership of the community.</td>
<td>Invite the showcasing of successful knowledge implementation. Use email or newsletters to communicate how the sharing of knowledge has helped solve problems or resulted in better practices.</td>
</tr>
<tr>
<td>5. Providing the community with learning experiences that promote the development of ICT capacity and collective efficacy.</td>
<td>Conduct professional learning activities where community members can begin to master knowledge and skills. Encourage work shadowing.</td>
</tr>
<tr>
<td>6. Creating a rhythm for the community members’ interactions.</td>
<td>Set regular times for all members of the community to meet. Email community members at regular intervals to notify them about hot topics of discussion or information about the next meetings.</td>
</tr>
<tr>
<td>7. Involving a representative of the school’s leadership regularly and peripherally in the community’s activities.</td>
<td>The principal can join community events to share in knowledge building, encouraging participation and demonstrate support for the community and its members.</td>
</tr>
</tbody>
</table>

**Limitations of the study**

This study employed a design-based research approach to enacting a community of practice intervention over two iterative cycles for the duration of two years. The design-based research approach is advocated as a research approach for doctoral
dissertations (Herrington et al., 2007). Two years was long enough for this study to explore the phenomenon under investigation; nevertheless, the longitudinal effects of conducting the study over more than two iterations could have revealed further insights into the co-construction of collective efficacy beliefs had the participants been provided with the opportunity to participate in additional iterations. However, in the context of Heron College this may not have been helpful even though the ICT CoP continued to exist after the study concluded.

The data analysed in this study were collected from six teachers from a single-site study; Single-site studies can suffer from a low generalisability and deep involvement with the study can create unconscious bias (Leonard-Barton, 1990). In contrast, multiple-site studies can support objectivity by reducing unconscious bias and increase the findings validity. However, a multiple-site study would not have supported the purposeful selection of both research site and participants, which was essential for this study. Furthermore, the goal of this research was to present a rich, contextualised understanding of how a professional learning and development framework could enhance the ICT capabilities of teachers. Despite the limitations of a single site, the overall findings in this study provide opportunities for further research.

Implications for the research

The findings of this study have implications for leading school improvement at the individual level and organisational level. At the individual level, the findings presented in this study may inform teachers and school leaders about the productive behaviour that they can engage in to support school-wide improvement through professional learning and development.

For teachers, the findings emphasise the importance of sustaining learning through engaging in practice-related discussions in both public and private spaces. When solving difficult problems, teachers should actively seek knowledge brokers that cross boundaries. School leaders that take the time to understand the needs and aims of the communities of practice present in their school can support the professional growth of their teachers. Supporting communities of practices through time and resources is required to realise and sustain professional learning and development.
At the system level, the results of this study have implications for improving practice across schools. Implementation of the design principles described in this study can lead and sustain school improvement through the mechanism of enhancing the collective efficacy beliefs of teachers.

**Recommendations for future research**

This research explored how a community of practice intervention could enhance teachers’ ICT capabilities with a focus on enhancing collective efficacy beliefs. While conducting this research, a number of other topics emerged as potential areas that warrant further investigation:

- *What impact would the Collective efficacy learning framework have on an established community of practice?* Due to the time limitations placed on completing doctoral studies, additional iterations were not feasible. Had the study been able to implement further iterations, the influence of the design principles on an established community of practice with a comparison to the early years of establishing a community of practice could have been explored in this study.

- *Could the Sociocultural model of collective efficacy beliefs from community of practice participation be applied to other professional learning communities?* This might be possible as communities of practice come under the umbrella term “professional learning community”.

- *Do emerging communities of practice have a hierarchy of needs?* As communities of practice arise from a motivation to learn and share practice are there contextual factors that must exist for a community to emerge and be sustained? The findings in this study present communities of practice as inseparable from the contexts that they inhabit, and the findings also indicated *time* and *resources* were two factors required to sustain teachers’ engagement in the ICT CoP.

- *What role do the core participants play in maintaining membership to community of practice?* The participants in this study had varying levels of engagement with the core members during this study. The core members in this study may have been able to support members negotiate the intrinsic tensions between work commitments and participating in a community of practice.
How much time should be allotted to professional learning and development for an intervention to be successful? Is there a range for an ideal amount? The lofty learning goals in this research had times where they were not realised during each iteration, and the findings in this study indicated that time was a significant factor. Identifying the time commitment required for a school to make changes through learning may help schools set realistic and attainable professional learning and development goals.

The recommendations for further research attest to the research required to refine our understanding of how contextual factors influence teachers’ participation in professional development and learning activities that are supported by the ubiquitous communities of practice that they engage in as educators.

This design-based research study was successful in achieving many of its original aims by having contributed to both theory and practice. The contribution to theory included identifying the role of digital pedagogy and direction-setting leadership practices on teachers’ co-construction of collective efficacy beliefs and professional learning and development activities to improve teacher’s ICT capabilities. The Collective efficacy learning framework developed in this study has contributed to practice by providing teachers and school leaders with a guide to instantiating a community of practice approach to support teachers’ professional learning and development in the domain of ICT capabilities. The societal benefits of implementing the Collective efficacy learning framework are effective and appropriate teacher ICT practices. In summary, this research project successfully conducted a promising and effective intervention to address a real educational problem.
References


Ripley, L. L. (2017). *In their own words: Teachers make meaning of participation in a community of practice*. (Doctor of philosophy), Montclair State University, Ann Arbor, MI.


Appendix A:

The stages of teacher ICT learning (Schibeci et al., 2008)

Referred to in Chapter 3: Stages of ICT learning framework on page 47.
# The stages of teacher ICT learning (Schibeci et al., 2008)

<table>
<thead>
<tr>
<th>Stage</th>
<th>Focus</th>
<th>Teacher activity</th>
<th>Professional development</th>
</tr>
</thead>
</table>
| 1. Where’s the ON button? | Technical ICT skills and personal confidence of the teacher | • Developing a sense of capabilities and significance of particular ICT  
• Learning how to use the device personally concerned with educational aspects  
• Developing confidence with a specific set of ICT capabilities relevant to class program | • Focus on technical operating skills  
• Mastering the technical aspects without direction  
• How to fix problems students might encounter |
| 2. Black Line mastery | Successful student and teacher use of ICT for particular tasks in existing curricula | • Special ICT lessons planned, in which successful deployment of a particular ICT is a key aspect  
• Preference for ideas tried by others, with recipes for successful classroom use; BLM provide student directions  
• Focus is on successful use by students; engagement and interest are key indicators of success  
• Student use for assessment tasks  
• Reporting to parents using ICT | • Focus on particular classroom activities  
• Detailed worksheets that “work”  
• Photocopyable activities with detailed student directions for ICT use  
• Pitched at particular local syllabus  
• Materials that students will find interesting  
• Classroom experts providing advice to novices; resource dissemination  
• Practical class management advice |
| 3. Routine student use | Routine use of technology as part of student learning (of non-ICT things) | • All lessons planned on the assumption that ICT is available and used where it helps  
• Comfortable not using ICT at all when that is appropriate  
• Some focus on learned discretionary use by students; independent use by students  
• Not all students doing the same thing with ICT at the same time | • Conversations between experienced peers  
• Innovative and unexpected uses  
• Student problems identified and discussed, not just success stories  
• Focus has moved to student learning, with ICT as a catalyst  
• Less focus on assessment |
| 4. What’s in the curriculum? | Curriculum development and school change as a result of ICT | • Using ICT as a basis for questioning of the status of some curriculum elements: deletions and additions  
• Considering future changes seriously in light of ICT  
• Reconsidering nature of school curriculum domains; cross-curricular integration | • Using ICT to challenge existing curriculum structures and school practices; peer debates  
• Looking forward with technological changes in mind |
Appendix B:

Information letter and participant consent forms

Referred to in Chapter 3: Participants on page 52.
Information Letter

Project Title: A community of practice approach to promote the co-construction of collective teacher efficacy to implement ICT

Investigator: Stuart P R Duvall
Contact Person: Stuart P R Duvall
Address: Murdoch College
Telephone No.: XXXX XXX XXX

You are invited to participate in this study.

Background
Research has shown that participating in a community of practice can support teacher professional development. Studies have been conducted on communities of practice showing that it has the potential to support information and communication (ICT) implementation in schools. I am interested to learn how the school context influences teachers' beliefs about individually and collectively implementing ICT. You are invited to participate in this research supporting teachers' professional development to implement ICT over Term 4, 2011 and Term 1, 2012.

Aim of the Study
I would like to know whether there are benefits to you from participating in a community of practice to support your ICT use. I will invite you to use the community of practice forum and also ask you to answer a few questions on your experience implementing ICT to see whether there is any relationship between the community of practice and teachers' beliefs about ICT implementation.

What Does Your Participation Involve?
As a participant you are invited to join three professional development sessions. Following these sessions, you will be provided with a forum to support your ICT implementation. At the end of Term
If I am able to take the findings of this small study and link them with wider studies, the result may be valuable for others and it may lead to an improvement in the professional development supporting teachers' ICT implementation.

Possible Risks
When teachers discover new practices, they have yet mastered, they can sometimes experience a short-term decrease in their efficacy beliefs. Nevertheless, in the longer term, learning new practices can create greater efficacy beliefs above those the teachers originally held.

Questions
If you would like to discuss any aspect of this study please feel free to contact either myself on mbl.XXXX XXX XXX or my supervisor, Dr Jan Herrington on ph. XX XXXX XXXX. Either of us would be happy to discuss any aspect of the research with you. You are welcome to contact us at that time to discuss any issue relating to the research study.

Once I have analysed the information, I will be putting on our web site a summary of our findings. You can expect to receive feedback in [timeframe].

We would like to thank you in advance for your assistance with this research project. We look forward to hearing from you soon.

This study has been approved by the Murdoch University Human Research Ethics Committee (Approval xxxx/xxx). If you have any reservation or complaint about the ethical conduct of this research, and wish to talk with an independent person, you may contact Murdoch University’s Research Ethics Office (Tel. XX XXXX XXXX [for overseas studies, +XX X XXXX XXXX] or e-mail XXXX@XXXX.XXX). Any issues you raise will be treated in confidence and investigated fully, and you will be informed of the outcome.
A community of practice approach to promote ICT implementation

I have read the Information letter about the nature and scope of this research. Any questions I have about the research process have been answered to my satisfaction. Therefore, I agree to take part in this research. By signing this Consent form, I give my consent for the community of practice communications to be used in the research and have been made aware of the following information:

- I am aware that the electronic communications collected from the community of practice forum is anonymous and no personal details are being collected or used.
- I understand that all information provided is treated as confidential by the researchers and will not be released to a third party unless required to do so by law.
- I know that I may change my mind, withdraw my consent, and stop participating at any time.
- I acknowledge that if I withdraw, all information I have provided will be destroyed.
- I understand that the findings of this study may be published and that no information, which can specifically identify me, will be published.

I __________________________ provide my consent to participate in the research being conducted by Stuart P R Duvall.

Signature __________________________ Date ________________
Appendix C:

Initial semi-structured survey questions

Referred to in Chapter 3: Initial survey on page 56.
Initial semi-structured survey questions

Background
- Could you share with me the ways you use ICT in the classroom?
- What would be your favourite way to use ICT in the classroom?
- What motivated you to join the ICT community of practice?

The benefits/challenges of using ICT at this school and self-/collective efficacy beliefs
- In your opinion, what are some of the challenges you have experienced this year when using ICT with your students?
- How do you deal with these challenges?
- How can you tell that the challenges have been overcome?

The Benefits/challenges for teachers engaged in a community of practice at this school and Self-/collective efficacy beliefs
- What have you found to be the challenges of participating in the ICT community of practice?
- What has made your participation easier?
- What strategies have you used to overcome these challenges?

The benefits/challenges presented by the physical environment of the school and self and collective efficacy
- How do the school’s resources help or restrict your use of ICT in the classroom?
- [If any obstacles are described] how do you overcome these obstacles?

How the student population influences the teacher’s belief in their capacity to use ICT
- Do you think your students influence how you use ICT in the classroom? How do they do this?
- Could you share with me, how well you address these issues?
How do community perceptions of the school influence a teacher’s belief in their capacity to use ICT?

• To what extent do you feel that the students’ parents influence ICT use at this school? How much of this influence extends to the teachers’ use of ICT?
Appendix D:

Questionnaire context matrix

Referred to in Chapter 3: Semi-structured interview: Iteration 1 on page 56.
## Questionnaire context matrix

<table>
<thead>
<tr>
<th>Physical environment</th>
<th>Students</th>
<th>Teachers</th>
<th>Leadership</th>
<th>Community perception</th>
<th>ICT at the school</th>
<th>ICT and the community of practice</th>
</tr>
</thead>
</table>
| **Background**       | 1. Tell me about the past strategies that have been used to implement technology at the school?  
2. Have you found any of these strategies particularly useful? |
| **Teacher efficacy** | 16. What student needs must be catered for when you are creating a learning activity supported by ICT?  
18. How do your students influence the way you use ICT?  
19. In your opinion, to what extent do teachers at this school influence how other teachers use ICT to support student learning?  
20. Can you describe how other teachers influence the use of ICT by students in your classroom?  
23. How do these community perceptions influence your use of ICT to support student learning by teachers at this school?  
3. In your opinion, what are the challenges of implementing lessons that require students to use ICT?  
5. How effective do you yourself feel in meeting the challenges that you outlined?  
8. What do you think are the challenges of participating in a community of practice at this school?  
10. How effective do you yourself feel in meeting the challenges that you outlined? |
| **Development of collective efficacy** | 24. What would you need to experience for you to raise your estimation of the teachers’ ability to use ICT for student learning? |
| **Collective efficacy Group competence** | 12. How successfully are the teachers at this school at meeting these challenges?  
17. Do you feel that the teachers at this school are able to meet these challenges?  
4. How effective would you say the teachers at this school are at meeting these challenges?  
9. How effective would you say the teachers at this school are at meeting these challenges? |
<table>
<thead>
<tr>
<th>Collective efficacy</th>
<th>Task analysis</th>
<th>11. What influence does the physical environment have over the teachers’ ability to deliver lessons when the students are using ICT at this school?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power (CoP)</td>
<td></td>
<td>6. What types of ICT decisions can teachers influence?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>21. The community has a perception of the school. How does this perception influence the use of ICT for teaching at this school?</td>
</tr>
</tbody>
</table>
Appendix E:

Second semi-structured interview questions

Referred to in Chapter 3: Semi-structured interview: Iteration 2 on page 57.
Second semi-structured interview questions

Introductory question
- What is your overall impression of the ICT Community of Practice?
- Could you describe some of the more notable experiences you have had?

The benefits/challenges of using ICT at this school and self-/collective efficacy beliefs
- What have your experiences been like with regard to the sharing of ICT knowledge and practices?
- How much do you think that these experiences have influenced how effectively you can use ICT at the School? How?

Self-/collective efficacy to influence ICT decisions and directions at the school
- From your experiences, as a member of the ICT community of practice, what types of contributions do the members of the community make that influence the use of ICT at a school-wide level.

How teachers in the community of practice influence other teachers’ beliefs in their capacity to use ICT
- In your opinion, how do the teachers who participate in the community of practice promote/support the ICT use of other teachers?

Self-/collective efficacy to influence ICT decisions and directions at the school
- From your experiences in the ICT community of practice, how have the core members influenced ICT use at this school for all teachers?

Identity
- Has what you learnt from the community of practice influenced how you see yourself as a teacher or your role as a classroom teacher?
- How would you describe to me the role you play in the community of practice?
- What factors would make it difficult for you to be more involved in the CoP?
- What have you taken from the CoP that has most influenced your teaching?
Appendix F:

Third semi-structured interview schedule

Referred to in Chapter 3: Semi-structured interview: Iteration 1 on page 57.
## Third semi-structured interview schedule

<table>
<thead>
<tr>
<th>Area of investigation</th>
<th>Interview question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of teaching area and its activities</td>
<td>Can you describe the subjects you teach generally and the tasks that students complete as they do your courses? What level? Lower school? Upper School? How many students are in your classes?</td>
</tr>
<tr>
<td>Antecedents to participation in the community of practice</td>
<td>Why did you join the ICT CoP? What was the history that provided a need for participation in the CoP? What factors influenced the way you have adapted your courses to include ICT?</td>
</tr>
<tr>
<td>Effectiveness of approach</td>
<td>How effective do you think the unit has been in facilitating student learning? How effective do you think the COP has been in facilitating teacher learning? How effective do you think that the CoP has been at developing a collective belief that teachers have the capacity to competently use ICT in the classroom?</td>
</tr>
<tr>
<td>Problems encountered</td>
<td>Were there any problems or difficulties that arose during the design and development stages? What problems have you encountered in teaching online? (Prompts: Time commitment, working it out as you go along, technology problems, resistance from other teachers, culture of school doesn’t support it)</td>
</tr>
<tr>
<td>Opinions on lesson planning</td>
<td>What were your own thoughts about designing a lesson around ICT activities? Did you have any personal difficulties, doubts or second thoughts?</td>
</tr>
<tr>
<td>Effectiveness of approach</td>
<td>How effective do you think the use of ICT has been in facilitating student learning?</td>
</tr>
<tr>
<td>Impact on teachers</td>
<td>What is your general impression of how the teachers have responded to the use of incorporating ICT into their teaching? What is your general impression about the capacity of the community as a whole to use ICT in the classroom? [how did this develop/what could have supported its development] What impact has the use of ICT had on all of the teachers at the school? What have been the outcomes of using ICT, generally for the teachers? Can you compare the impact on teachers to when ICT was less of a priority at the school?</td>
</tr>
<tr>
<td>Area of investigation</td>
<td>Interview question</td>
</tr>
<tr>
<td>-----------------------</td>
<td>--------------------</td>
</tr>
</tbody>
</table>
| Impact on students    | What problems have students had?  
What is your general impression of how the students responded to the tasks?  
What impact has the use of ICT had on students? What have been the outcomes of the courses using ICT, generally for the students?  
Can you compare its impact to an earlier version of the course that may have been taught in a different mode?  
Were there any major problems with students, and if so, how did you sort them out? |
| Outcomes              | What have been the outcomes of joining the CoP for yourself professionally? |
| Willingness to repeat | How willing would you be to continue being involved in the CoP? Reasons?  
Would you use ICT as a central part of your course design? |
| Advice for newcomers  | If a teacher asked you for advice on using ICT, what advice would you give? |
| Opinion on characteristics which enable ICT lesson to be conducted | What is your opinion of the importance of the task when using ICT with students?  
When you designed ICT tasks in [name of course] what were the essential elements that needed to be included?  
What are the characteristics of an ICT task that enable much to be learned from its completion?  
What preparations did you make, or what new skills did you need to learn before you began teaching with ICT?  
What observations have you made about the differences in teaching with and without ICT? |
| Opinion on model      | In your opinion, what are the important characteristics of the design of the activities in online units? How important is it that the tasks:  
1. share experiences with outsiders  
2. allow different levels of participation  
3. receive positive feedback and praise  
4. have spaces for the community to communicate  
5. view other teachers model ICT use  
6. be reminded of the value of maintaining membership to the community  
7. engage in activities that help master ICT knowledge and skills  
8. feel positive about using ICT  
9. cultivate a belief that collectively the teachers are competent to use ICT  
10. create a rhythm for the community member’ interactions. |
| Additional elements which could be included in model | Are there any other characteristics of activities that you believe are important that have not been mentioned so far? |
Appendix G:

ICT CoP email

Referred to in Chapter 4: Create a rhythm for the community members’ interactions on page 74.
Hello ICT CoP Participants

The ICT CoP website is up and running! I was unable to upload all the videos from home as the file sizes were too large. Therefore, sorry it is a couple of days later than I previously advised.

I placed the ICT CoP page on the LMS under the course category, 'Information and help'. It is called, 'HC ICT CoP'.

You may have become aware that there is a big community emphasis on ICT. The idea is that we are a community of teachers learning about the practice of ICT implementation (a community of practice).

The big difference between traditional forms of PD and our community is that ours is customised to: the individual teacher, the College setting and engaged with over an extended period of time. This approach has benefits over the traditional seminar and workshop approach as it: is personalised, provides time to master the necessary skills and allows the sharing of knowledge between teachers. This last point is important. It is estimated that 90% of our professional learning comes from those, “How do you...?” discussions between our fellow colleagues.

The introductory information is now available for you to have a look at and I will post some more once you have had time to check out the introduction.

Regards

Stuart
Hi everyone,

Discussion on the introduction of technology in the classroom is not a new phenomenon. Eighty years ago teachers and researchers began debating the educational benefits of films. Today students are presented with unprecedented access to educational experiences through the content presented on the World Wide Web. For example, a student armed with an iPhone can instantly access much more knowledge than any one individual could ever recall. This change in information access is slowly redefining the role of the teacher.

What is beginning to emerge now is a global effort by teachers to meet these 21st Century educational challenges and provide our students with education experiences that employ best practice. Consequently, the teachers at [blank] are proudly embracing this challenge firstly, by supporting the one-to-one Apple MacBooks initiative and secondly, through participation in an ongoing professional development program focused on the theory and skills required to effectively use technology in the classroom. This year, twelve dedicated teachers participated in the ICT Community of Practice to learn and share their knowledge of ICT practice with each other.

Stuart Duvall and [blank] would like to thank [blank], [blank], [blank], [blank] and [blank] for their enthusiastic engagement and commitment to embrace ICT in the classroom.

Regards

Stuart.
Appendix H:

ICT CoP meeting agenda

Referred to in Chapter 3: Create a rhythm for the community members’ interactions on page 74.
ICT CoP meeting agenda

Agenda

ICT CoP meeting
Date: 20th January 2024
8:40am – 1:00pm

Attendees:

Please bring: laptop

8:40am – 12:30pm
• Present the agenda.
• Discuss the ‘EPICT’ overview and about the EPICT program to participants. This includes a presentation and movie.
• ‘Walk’ through the website. Awareness of features.
• Discussion of role of steward.
• Review the document ‘Pedagogies and ICT Integration’.
• Module intergration.
• Josephine Illuru showcase: Aboriginal and Torres Strait Islander Histories and Cultures presentation task.
• Any other business.
• Confirm next meeting.