School of Education

Investigating Teachers' Confidence in their Use of Technology, Burnout, Self-Efficacy and Satisfaction: Relationships and Differences between Groups

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DECLARATION

To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgment has been made.

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.

The research presented and reported in this thesis was conducted in accordance with the National Health and Medical Research Council National Statement on Ethical Conduct in Human Research (2007) – updated March 2014. The proposed research study received human research ethics approval from the Curtin University Human Research Ethics Committee (EC00262), Approval Number SMEC-29-13

Signature:

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ABSTRACT

The digital technology landscape in schools has changed the way that students learn and teachers teach. In this climate of increasing presence and use of digital technologies in the classroom, the overarching aim of the study reported in this thesis was to examine how (or indeed whether) teachers' confidence in their skills and knowledge related to their use of ICT and whether this influenced their self-reports of burnout, self-efficacy and satisfaction.

The study involved developing and administering three surveys: one to assess confidence in ICT pedagogical knowledge (known as the CIP Knowledge Survey); one to assess confidence in ICT pedagogical skills (known as the CIP Skills Survey); and one to assess teachers' burnout, self-efficacy and satisfaction with using ICT (known as the BESS). Using the newly-developed surveys, data was collected from 163 teachers from 11 Catholic schools and four independent schools located in rural and metropolitan South Australia.

The first imperative of the study was to provide evidence to support the reliability and validity of three surveys. Although the analyses were conducted separately for each survey, the results showed that: the factor loadings for individual items were all above .40 on their *a priori* scale and less than .40 on all other scales; the eigenvalues for all scales were greater than 1; and the Cronbach alpha coefficients for different scales were all above .80 (with the individual as the unit of analysis).

The second objective was to investigate whether teachers' confidence in using technology was related to teachers' sense of burnout, self-efficacy and satisfaction. The results indicated that teachers' confidence, with respect to both their pedagogical ICT knowledge and pedagogical ICT skills were statistically significantly and positively related to teachers' self-efficacy and satisfaction with using ICT. The findings suggest that those teachers with more ICT knowledge and skills' confidence were more prone to have better self-efficacy and satisfaction.

The third objective was to investigate whether teachers' confidence (with respect to their knowledge and skills of ICT usage), burnout, self-efficacy and satisfaction

differed for groups based on: sex; age; and the frequency of technology usage. MANOVAS were conducted separately for the three surveys. For differences between male and female teachers, the results suggested that teachers, regardless of sex, have similar levels of confidence towards technology use. The results indicated that there was a statistically significant difference ($p < .05$) between males and females for only one scale, self-efficacy to influence decision making scale, with males reporting more positive self-efficacy when using ICTs than their female counterparts.

For differences between the three age groups (less than 35 years old, 35 to 54 years old, and more than 54 years old), the results suggested statistically significant differences overall. Using Tukey's HSD multiple comparison procedure, it was found that teachers less than 35 years of age, when compared to teachers in older age brackets, were more confident in terms of both their knowledge of ICT and skills related to ICT. However, the univariate ANOVA results indicated that, for teacher burnout, self-efficacy and satisfaction with working with ICT, the results were not statistically significant.

For differences between the frequency of technology use (less than 11 hours per week, 11 – 20 hours per week, 21 – 30 hours per week, and greater than 30 hours per week), the results indicated that, generally, teachers who used technology more frequently reported higher levels of confidence, self-efficacy and satisfaction. The ANOVA results suggest that there were statistically significant differences for two of the four scales: self-efficacy to influence decision making and satisfaction with working with ICT.

The study reported in this thesis is one of only a handful of studies that have examined teachers' confidence with using ICT in the classroom and, as such, contributes to the literature related to technology use in schools. The results of the study could be of significance to a range of stakeholders, including teachers, principals, school administrators and professional development providers. Principals may benefit from this study because it could underpin the importance of developing confidence amongst teachers through vicarious experiences (Bandura, 1977) when working with technology. The results can be used as a guide for professional learning practices in

using digital technologies specifically as school leaders consider how to improve teachers' self-efficacy, satisfaction and technology confidence.

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INTRODUCTION

1.1 Introduction

The twenty-first century has seen a rapid development of information technologies and an increase in its use across society. Very few groups in the community have not been impacted by the presence of information technology. As digital devices become more accessible, technology use becomes more apparent. The Australian Bureau of Statistics (ABS) *Household Use of Information Technology* (2016–17) report indicated that technology use at home had increased considerably from 44% in 1998 to 86% in 2016. The Australian Communications and Media Authority (ACMA) (2016) Research Snapshot reported that 86% of all teens have broadband access at home, with 91% using a computer for access, 78% using a mobile phone and 39% using a tablet. The ACMA (2016) also reported that digital access by older Australians (aged over 65) had increased from 65% in 2011 to 79% in 2015, demonstrating that the increase in digital use is not restricted to the younger demographic.

The increase in technology use in everyday life has impacted most parts of society, including schools, teachers and students. Teachers are increasingly expected to use technology as an essential tool to adequately meet the needs of the twenty-first century learner (Ertmer & Ottenbreit-Leftwich, 2010). Riding each wave of digital innovation, debating each invention and adopting the latest device, schools across Australia have experienced a transformation in lesson design, pedagogy and integration. In doing so, teachers and school leaders have grappled with developing their own skills and knowledge as they aim to keep up with the rapid growth and changing nature of technologies in the classroom. The inspiration for my study came from observing teachers' confidence as they learned how to use ever evolving technology in the classroom. Some teachers appeared to apply a high sense of efficacy towards using technology, while others appeared overwhelmed and disengaged. The overarching aim of my study, therefore, was to understand teachers' confidence related to the use of technology as a learning and teaching tool

in the classroom. Specifically, the study examined how teachers' confidence in technology use impacted on their self-efficacy, satisfaction, and feelings of burnout.

This chapter provides an introduction to this thesis. First, the context of my study is outlined (Section 1.2). A description of the research paradigm used for this thesis is then provided (Section 1.3). This is followed by a description of the aims, objectives and hypotheses for my study (Section 1.4). The final sections of this chapter outline the significance of the study (Section 1.5) and concludes with an overview of the thesis (Section 1.6).

1.2 Context of the Study

The use of Information Communication Technologies (referred to in this thesis interchangeably as ICT or technology) in the classroom has become integral to the way in which students learn and teachers teach. The rapid development of technology use in the classroom has led to an increase of digital programs, applications and resources that teachers are able to use. This 'digital turn' (Buchanan, 2011) incites enthusiasm and excitement towards technology along with apprehension, as teachers grapple with the pedagogical impact of using technology with their students.

The complexity of the classroom digital narrative has persuaded educators to change the way in which lessons are taught and led governments across the world to identify measurable targets for supporting technology integration within education (Hermans, Tondeur, van Braak & Valcke, 2008). The introduction of the Australian Government's Digital Education Revolution (DER) Policy (2008) quickly placed technology at the fingertips of all year 9 to 12 students; which directly changed schooling in Australian schools (White, 2008). Competent use of technology by both students and teachers is no longer considered debateable (Christensen & Knezek, 2008) and most schools have become well equipped with the digital technology devices and technology policies along with the 'digital native' ready for twenty-first century learning.

At the time that this study was undertaken in 2014 the technology climate in schools was heating up. According to the 2013 Digital Education Advisory Group (Alexander,

Barnett, Mann, Mackay, Selinger & Whitby, 2013) investing in digital education was changing both how and what students learn, when they have access to digital devices. This same advisory group identified ten key findings to support schools to take up digital technologies to improve teaching and learning. Access to technology was increasing with the development and ease of the smart device along with the introduction of other digital resources such as smartboards, digital projectors and laptops. Mobile devices became increasingly popular between 2009 and 2012 allowing schools to move away from separate computer rooms and towards an anywhere, anytime model for learning with digital devices (OECD, 2015). Pegrum, Oakley and Faulkner (2015) outline a number of educational institutions and their intentional injection of digital technologies to students. These include, the 2011 iPads for Learning project in the state of Victoria with 700 iPads being distributed to students across nine schools. In addition to the adoption of mobile devices, digital tools and software were being developed, mastered and replaced at a considerable pace. Teachers scrambled to keep up with the pace of change and innovation whilst students arrived with increasing access and technology knowledge.

The Australian Curriculum Assessment and Reporting Authority (ACARA, 2012) outlines curriculum expectations in the national curriculum, highlighting technology use and the skills which teachers are required to teach. Furthermore, as outlined in the ACARA document *The Shape of Australian Curriculum: Technologies* (www.acara.edu.au), technology is seen as a tool for meeting the diverse needs of students, allowing for integrated learning. Teachers are required to teach the technology curriculum as outlined by ACARA, thus exposing teachers to a digital setting and methodology despite their prior knowledge or acquired skills.

Technology can be disruptive to teachers who once considered themselves at the centre of learning and, as such, new skills and knowledge need to be developed (Somekh, 2008). Technology knowledge and skills are now considered to be essential qualities of any good teacher (Ertmer et al., 2010) and the Australian Digital Education Revolution policy commands a world class education, in which innovation using technology is expected (White, 2008). In addition, educational practices and pedagogy are needed to meet the learning style of the technology generation (Buchannan, 2011).

Technology use in the classroom that meets the needs of the students provides teachers the opportunity to move away from being the primary source of information, towards a collaborative pedagogy for student success (Kozma, 2003). Using technology as a tool, assists the teacher in shifting the learning from the industrial age to the knowledge age (Kimber, Pillay & Richards, 2002). This requires teachers' confidence in technology knowledge and skills to respond to students' individual needs, teach in creative ways and design engaging learning activities. Pedagogical implications for using mobile devices in the classroom requires educators to change their teaching to make it more collaborative (Murray, 2010), relevant and engaging (Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur & Sendurur, 2012) and to drive its improvement (Lawrence & Tar, 2018).

An early study by Woodhouse and Jones (1988) recognised the constraints associated with computer use in the classroom that included lack of knowledge by the teacher. Since then, much research has examined how teaching and learning using ICT can be improved. Effective professional development continues to be identified as a significant contributor (Lawless & Pellegrino, 2007) to developing confidence in the skills and knowledge to use ICT. Collaboration and professional learning teams have been identified as the best means of developing technology skills for teachers (Inan & Lowther, 2010; Lemon & Garvis, 2016; Webb, Robertson & Fluck, 2005). Knowledge and skills were understood for this study by examining the confidence teachers have in using technology to work collaboratively with colleagues.

My study was designed in response to personal observations of teachers' level of confidence with using technology in the classroom. Given this rapid evolution of technology in the classroom, my study sought to examine the impact on teachers' confidence as they use technology. For the purpose of this study, confidence is examined through the lens of measuring ICT pedagogical knowledge and skills. Furthermore, technology pedagogical knowledge and skills have been measured through the lenses of planning and communication along with digital citizenship.

The next section describes the research paradigm selected for this study.

1.3 Research Paradigm of the Study

All research sits within at least one paradigm that can be used to express the assumptions about truth and reality (Kuhn, 1970; Willis, 2007). It is important for researchers to overtly acknowledge the research paradigm drawn upon in order to enhance the validity of the research. This section identifies the research paradigm drawn on in the present study.

Given the exploratory nature of the present study, it made sense to draw on the post-positivist paradigm. According to Anderson and Arsenault (2005), educational research has been influenced by the scientific method of positivism, a quantitative approach measuring observable behaviours. The positivist paradigm adopts an ontological (study of reality) and epistemological (theory of knowledge) approach. According to Kaboub (2008) (found in Leong, 2008, p. 343), "the positivist paradigm asserts that real events can be observed empirically and explained with logical analysis". However, this paradigm has been criticised because of limitations regarding observations of human behaviour by the individual (Panhwar, Ansari & Shah, 2017). Post-positivist paradigm, on the other hand, recognises that observations depend on the personal perspective of researchers and what they are looking for. Working from a naturalistic setting, post-positivism allows the researcher to gather data based on opportunity and from participants who have a vested interest in the data (Anderson et al., 1998). Panhwar et al. (2017) adds to this by arguing that post-positivism uses various instruments to examine data in order to understand a phenomenon as much as possible, rather than finding absolute truth. Post-positivism involves a multi-dimensional and multi-methods examination of the research to synthesise objectives, epistemology, methodology and evidence (Panhwar et al., 2017).

My study collected only quantitative data (using closed survey responses). As such, the study was considered to be post-positive. Further, the study was exploratory and conduced in the natural setting (e.g. teachers in schools).

1.4 Research Objectives, Hypotheses and Conceptual Framework

The overarching aim of my research was to better understand the impact of technology use by teachers. Specifically, the research examined whether the level of teachers' confidence with using technology was related to burnout, self-efficacy and satisfaction. To investigate this aim, three objectives and six hypotheses were delineated.

1.4.1 Research Objective One: Validity of Surveys

Examination of the impact of technology use by teachers required the development of a reliable and valid instrument. In order to establish confidence in the findings, evidence to support the reliability and validity of this instrument was needed. Following an examination of several measurement tools and surveys, the first objective of my study was:

To develop and provide evidence to support the reliability and validity of the three surveys used in the present study to assess:

a. *Confidence in ICT Pedagogical Knowledge (CIP Knowledge Survey);*
b. *Confidence in ICT Pedagogical Skills (CIP Skills Survey);*
c. *Teachers' burnout; self-efficacy to influence decisions, self-efficacy when using ICT and satisfaction with working with ICT (BES Survey).*

1.4.2 Research Objective Two: Links Between Teachers' Confidence and Burnout, Self-efficacy and Satisfaction

The second research objective, stated at the end of this section, was drawn from three hypotheses that are described and justified below.

Burnout refers to physical, emotional and cognitive exhaustion (Goddard & Goddard, 2006). Teacher burnout begins with disengagement (Maslach & Leiter, 1997) and has three dimensions: emotional exhaustion, depersonalization and negative personal accomplishment (Maslach, Jackson & Leiter, 1996). Measuring teacher burnout provides an understanding of the predispositions of the participants towards their work. The introduction of technology in the classroom has signalled the important role ICT

plays in improving the quality of teaching and learning (Lawrence et al., 2018). As a result, teachers have had greater demands on them as they learn new ICT skills and knowledge. This increase in pressure can lead to fatigue and pessimism. For the purpose of this study teacher burnout refers to exhaustion, cynicism and inefficacy (Maslach, Schaufeli & Leiter, 2001). Teacher burnout, specifically related to student behaviour, has been extensively examined (see, for example, McCormick & Barnett, 2011; Schaufeli, Leiter & Maslach, 2009). The purpose of my study was to examine if teacher burnout is related to confidence in technology use, thus extending the research on burnout beyond student behaviour. Therefore, it is hypothesised that teacher burnout is related to confidence in technology use.

For the purpose of my study, teacher self-efficacy refers to the perceived set of beliefs that a teacher has towards achieving success (Bandura, 2006). Therefore, teacher self-efficacy has been defined as the belief that teachers have in their ability to generate change, build pedagogical knowledge, and develop pedagogical skills and dispositions in themselves and their students. The relationship between teacher self-efficacy and confidence in technology use can be understood by examining how teachers believe that they can master the use of technology. Whilst technology knowledge and skills are needed to be successful with computers, self-efficacy is considered a more important attribute (Ertmer et al., 2010). Teachers' self-efficacy drives the individual's belief in their capability to achieve or perform (O'Neil & Stephenson, 2011). As teachers realise the place and relevance of technology in the classroom, they draw on their self-efficacy to embrace (or reject) its successful use in the classroom. Past research indicates that successful integration of ICT is related to teachers' self-efficacy (Sang, Valcke, van Braak & Tondeur, 2010) and confidence with using ICT is derived from teachers' perception of the likelihood of success (Peralta & Costata, 2007).

It is conceivable that teachers' confidence in using technology is related to their self-efficacy. Teachers' personal belief about their technology use contributes to how they manage their work. A strong sense of self-efficacy with technology could lead a teacher to get through to difficult students, keep students on task, motivate students and lead students to work together. Ertmer et al. (2010) suggest that self-efficacy is more important than knowledge and skills about using technology. A high level of confidence with technology contributes to positive teacher self-efficacy, and

adversely, a low level of confidence with technology contributes to low teacher self-efficacy. In my study I examined how teachers perceived their ability to succeed with using technology and hypothesised that teacher self-efficacy is related to the level of confidence in technology use in the classroom.

Teacher job satisfaction has been examined in numerous studies and can be understood from various perspectives. Generally speaking, it includes a set of positive or negative feelings towards one's job (Darmody & Smyth, 2016). Whilst this definition is useful, the purpose of my study was to examine satisfaction specifically with teachers' use of ICT. According to Cheok and Wong (2015), satisfaction can be considered as one's personal happiness index and is measured by the gap between expectation and experience. Teachers with high self-ratings of skills, values and accomplishments have a higher sense of satisfaction (Chapman & Lowther, 1982). Furthermore, teacher satisfiers are derived from intrinsic experiences (Dinham & Scott, 1996) such as student and teacher achievement. The higher the sense of competency (skills and knowledge), the more confident teachers are in using ICT (Tasir, Abour, Halim & Harun, 2012). It is reasonable to suggest that teachers who have low confidence in their ICT pedagogical knowledge and skills probably hold some negative feelings and are less satisfied in their work. Teachers who enjoy using technology might have low confidence but they are able to maintain a sense of satisfaction. Measuring teacher satisfaction with working with technology provided insight into how teachers were feeling about technology use.

For the purpose of this study, teacher satisfaction refers to the positive or negative feeling one has regarding their work (Zanders, 2011). Given that a high level of self-confidence has been linked to greater satisfaction (Wagh, 2016), I examined how satisfaction is related to teachers' confidence in their use of technology. Therefore, in this study, I hypothesised that teacher satisfaction with working with technology was related to confidence in technology use.

Given these three hypotheses, the second research objective was:
To investigate whether teachers' confidence levels, when using technology with students, are related to the teachers':

a. *Burnout;*

b. *Self-efficacy;*
    a. *to influence decision making;*
    b. *when using ICT; and*
c. *Satisfaction with working with ICT.*

1.4.3 Research Objective Three: Determinants of Teachers' Confidence, Burnout, Self-efficacy and Satisfaction

The third research objective was based on three further hypotheses. This section outlines the three hypotheses and then states the objective.

A number of studies suggest that male teachers have been more successful in using technology in the classroom with students (Broos, 2005; Cai, Fan & Du, 2017; Jamieson-Proctor & Finger, 2008). Although males predominantly teach subjects such as IT and computing (Weldon, 2015), and given that females make up approximately 75% of the teaching population (ABS, 2017), it is worth examining further the confidence of male and female teachers as they use ICT in the classroom. My study assesses teachers' confidence in technology use to manage student data, work with colleagues and communicate with parents. Given the disparity between which sex predominantly teaches technology, this study hypothesised that teachers' confidence in ICT pedagogical knowledge and pedagogical skills would differ for males and females.

Early career teaching often coincides with being a young adult. However, whilst he or she might still be establishing professional confidence and competence, the young teacher is also likely to be adaptable and flexible. The mid-career teacher is confident, competent and selective about educational change whilst, by and large, the older teacher is considered both resistant to change and resilient towards the expectation to change (Hargreaves, 2005). ICT integration, as a form of educational change, is complex and complicated (Tondeur, Devos, Van Houtte, van Braak & Valcke, 2009), requiring teachers to confidently leverage the use of ICT to enhance student learning (Ertmer et al., 2010). It was anticipated that there would be a difference in how teachers, of varying ages and years of experience, approach this educational change.

Therefore, this study hypothesised that teachers' confidence in ICT pedagogical knowledge and pedagogical skills would differ for teachers of different ages.

The temporal lens of frequency (Venkatesh, Maruping & Brown, 2006) was used to examine levels of perceived confidence with technology in this study. According to Venkatesh et al. (2006), any behaviour that is infrequent and irregular is likely to impede performance in that behaviour. It is conceivable that teachers who use technology more often have higher confidence than those who limit their use. Therefore, it is hypothesised that teachers' confidence in ICT pedagogical knowledge and pedagogical skills would differ depending on the number of hours for which technology was used.

Based on these three hypotheses, the third research objective was:
To investigate whether confidence, burnout, self-efficacy, and satisfaction differ for:

a. *Male and female teachers;*
b. *Teachers of different ages; and*
c. *Teachers who use technology for different amounts of time.*

1.5 Significance of this Study

This study contributes to the extensive understanding of the changing role of teachers in the classroom and the skills they are required to have because of technology use in education.

This study contributes to the growing body of research related to teachers' confidence (see, for example, Ertmer, 1999; Ertmer & Ottenbreit-Leftwich, 2010; Goos & Bennison, 2006; Petty, Brinol, & Tormala, 2002; Ross, Hogaboam-Gray & Hannay, 1999; Stankov et al., 2012). The study has extended this past research by including teachers' confidence exclusively with using technology. Certainly, there has been limited (if any) research purposely involving South Australian teachers and assessing their confidence with using ICT. Thus, this study fills the gap in research related to teachers' confidence with using technology in the classroom.

The study provided an assessment of the relationship between teachers' technology confidence with a range of outcomes including, burnout, self-efficacy and satisfaction. Most notably was the absence of literature related to teachers' ICT confidence and their satisfaction. Teachers' satisfaction and job satisfaction have been considered by a number of researchers (see, for example, Aldridge & Fraser, 2016; Dinham & Scott, 1997; Herzberg, Mausner & Snyderman, 1959; Locke, 1969; Sergiovanni, 1967; Wagh, 2016). However, there is limited research on teachers' satisfaction with using technology. Teachers' satisfaction was an important aspect of my study and as such, contributes to the dearth of research on teachers' satisfaction with working with technology.

My research contributed to the understanding of teachers' confidence with ICT and how this differs for teachers of different ages and sexes. Although the sample was confined to one state in Australia, and should be transferred with caution, the results do, nonetheless provide useful information to schools and education systems. This knowledge can be used to guide professional development and to target groups that may need more help to develop confidence in their use of ICT. Professional development that leads to improved self-efficacy provides teachers with an understanding of both their success and their failures (Pfitzner-Eden, 2016) when using technology. As the study examined the relationship between confidence in ICT pedagogy with self-efficacy and satisfaction with working with technology, it may contribute to teachers' understanding of how their confidence levels can improve. Principals may benefit from my study because it could underpin the importance of developing confidence amongst teachers through mastery and vicarious experiences (Bandura, 1977) when working with technology.

Methodologically, my study adds to the limited number of available instruments to assess teachers' confidence, specifically with respect to ICT. At present, schools and education systems lack available tools to evaluate teachers' confidence with the use of ICT. This study made an original contribution by developing and providing evidence to support the reliability and validity of three surveys to assess: Confidence in ICT Pedagogical Knowledge (CIP Knowledge Survey); Confidence in ICT Pedagogical Skills (CIP Skills Survey); and confidence in technology in terms of: teachers'

perceptions of burnout; self-efficacy to influence decision making; self-efficacy when using ICT; and satisfaction with working with ICT (BES Survey).

The significance of this study is outlined in more detail in Chapter 5 of this thesis.

1.6 Overview of the Thesis

In this chapter, an introduction to my study has been outlined followed by the context of the study. The research paradigm, aims, objectives and hypotheses have been described. The chapter has concluded by providing a brief description of the significance of this study.

In Chapter 2, literature related to technology use, confidence, burnout, self-efficacy, and satisfaction is reviewed. Technology use is defined by drawing on both teacher and student experience. Teacher confidence is defined and past research related to male and female confidence is examined. Furthermore, literature related to teachers' years of experience and confidence is also considered. The chapter then defines and reviews literature related to burnout. The three dimensions of burnout, as described by Maslach, Schaufeli & Leiter (2001), are reviewed and a definition of burnout is provided. Teacher self-efficacy is explored by examining Bandura's (1986, 1997) four-source theory and teachers' self-belief in the capacity to provide meaningful learning (Lemon & Garvis, 2016). Whilst there appears to be limited literature on teacher satisfaction and technology confidence, a definition of teacher satisfaction is provided by conducting research on job satisfaction (Dinham & Scott, 1997). Chapter 2 also provides a review of tools used for measuring confidence, burnout, self-efficacy and satisfaction.

Chapter 3 provides details of the research methods used to complete this study. The research aims and objectives are re-stated and the sample is described. The design of the instruments used to collect the data are explained. The pilot study and data collection are explained. The chapter concludes by investigating the ethical considerations and the processes followed to address or minimise these.

In Chapter 4, the results of data analysis are reported. First, evidence to support the validity and reliability of the three surveys is provided. Second, associations between teachers' technology confidence and burnout, self-efficacy and satisfaction are reported. The chapter then reports the differences in technology confidence between males and females, different age groups and teachers who use technology for different amounts of time.

The thesis is concluded in Chapter 5 by providing a summary and discussion of the results. The limitations of the study are described and recommendations based on the study are provided. The significance of the study is presented in this chapter which finishes with concluding remarks.

Chapter 2

LITERATURE REVIEW

2.1 Introduction

The purpose of this research was to investigate teachers' confidence in their knowledge and skills related to using Information Communication Technology (ICT or technology) and how they are related to teachers' confidence, burnout, self-efficacy and satisfaction. This chapter reviews the literature pertinent to this study. Section 2.2 reviews the literature related to technology use in the classroom. This is followed by a review of the literature related to teacher confidence, particularly with respect to use of ICT (Section 2.3), teacher burnout (Section 2.4), teacher self-efficacy, (Section 2.5) and teacher satisfaction (Section 2.6). The chapter concludes with a summary (Section 2.7).

2.2 Technology use in the Classroom

In order to understand teachers' confidence in using technology, it is worthwhile to examine literature that describes classroom technology and how it is used. This section starts by defining technology use in the classroom for the purpose of this study (Section 2.2.1) and reviews past literature on technology use in the classroom (Section 2.2.2).

2.2.1 Defining technology use in the classroom

In defining technology in the classroom, there are three aspects to consider: the hardware and software that is used (described in Section 2.2.1.1); the students who will use it (described in Section 2.2.1.2); and the pedagogy used by the teacher (described in Section 2.2.1.3).

2.2.1.1 Technology resources (hardware and software)

Understanding the resources associated with technology, such as the hardware and software that are available in the classroom, contributes to defining technology use in the classroom. Hennessy, Ruthven and Brindley (2005, p. 155) describe technology as

"the range of hardware (desktop and portable computers, projection technology, calculators, data-logging, and digital-recording equipment), software applications (generic software, multimedia resources), and information systems (Intranet, Internet) available in schools at the time of the research". Adding to this definition, Bharati (2014, p. 5) describes modern technology as being a combination of software and hardware, stating that hardware includes "desktops, laptops, palmtops and tablets" and gives examples of software such as "word processing, spreadsheets, power point [sic] presentations, excel and multimedia software".

In addition to hardware, the use of mobile devices in classrooms is becoming more prevalent (Parasuraman & Colby, 2015). Mobile devices have the capacity to store data, access the internet, word process and transfer information (Peters, 2007).

Examining the availability of technology resources such as hardware and software alone, although carried out in other studies (see, for example, Arouri, 2013; Goos & Benison, 2006; Wan, 2012), is somewhat limited. Understanding the adequacy of technology resources available to the teacher, whilst useful, is limited to technology tools as opposed to the technology user, that is, the student and the teacher (Dawson, 2008; Dutton, 2012; Masango, 2014). Whilst this study did not involve technology resources in the classroom, it is helpful to identify the technology resources that contribute to defining technology use in the classroom.

2.2.1.2 The user of technology (student and teacher)

Understanding the user experience of technology contributes to defining technology use in the classroom and is particularly relevant to the research described in this thesis. Just as the definition for technology has evolved, so too has the definition of the technology user. For the purpose of this research, both teacher and student are considered to be users of technology in the classroom setting. Characteristics of the two users (teacher and student) are discussed below.

The term 'digital native' was used by Prensky (2001, p. 3) to describe students in the classroom as a result of their exposure to the digital world, almost from birth. He also introduced the term 'digital immigrant' to describe teachers who, not born into the

digital world, have adopted technology use. As insatiable users of technology, digital natives demand a learning style that matches their digital world (Buchannan, 2011). On the other hand, in an early analysis of the digital native debate, Bennett, Maton and Kervin (2008, p.782) cautioned against 'a dramatic shift from text based' to constructivist, problem solving, digital resources approach to learning. They argued that despite the technology rich world of young people, there was little evidence to suggest that students' learning style had changed.

Prensky's digital native and digital immigrant terms were intended to identify generational differences by age, signalling two different demographics (youth and adult) who were using technology. The digital native term espoused by Prensky has been the subject of counter argument. Specifically, Helsper and Eynon (2010) suggest that a digital native is not solely defined by age bracket. Significantly, they add breadth of use, experience, gender and educational levels as factors that contribute to the definition of a digital native, thus challenging the generational interpretation of the term 'digital native'.

Wang, Myers and Sundaram (2013) also disagree with the dichotomy described by Prensky, suggesting that there is a continuum between being a digital native and a digital immigrant. This continuum, presented as a conceptual model, is described as digital fluency which is not necessarily limited by age groups. This conceptual model of digital fluency includes the following factors: organizational factors; demographic characteristics; psychological factors; social influences; opportunity; behavioural intention to use; and use of digital technology. Wang et al. (2013) identified opportunity and behavioural intention to use as the two factors contributing to the differences in digital fluency between digital natives and digital immigrants. The digital fluency conceptual model includes both age and gender as determinants of the demographic characteristics factor. The continuum concept is supported by Helsper and Eynon (2010) who suggest a continuum of engagement is less harmful than the generational distinctions natives and immigrants.

The conceptual model offered by Wang et al. (2013), based on empirical data collected from the digital immigrant, illustrates the concept of digital fluency, which influences technology use. Both teachers and students experience digital fluency when they use

the digital platform to creatively express knowledge and information (Wang et al., 2013). This model suggests that Prensky's differentiation, based on age, no longer exists as [more than 10 years on] the 'digital native' has now entered mainstream society (Soujah, 2014).

The study presented in this thesis adds to the digital fluency conceptual model by providing further data (age, sex and frequency of use, along with self-efficacy and satisfaction) on teachers' confidence with technology. In defining technology in the classroom, the terms digital native, digital immigrant and digital fluency provide a lens through which the technology user can be understood.

2.2.1.3 Teacher pedagogy using technology

Teacher pedagogy can be generally understood as the processes and practices used by teachers to engage students in their learning. Ertmer and Ottenbreit-Leftwich (2013) argue that, as a cognitive tool, technology has the power to be used to create engaging meaningful learning. However, they also point out that its presence alone does not change pedagogy. Teachers are urged to use technology in order to provide engaging learning whilst also leading students to be "creative and productive users of technology…" (Barr, Gillard, Firth, Scrymgour, Welford, Lomax-Smith, ... & Constable, 2008, p.8). The research described in this thesis took into consideration the complexities of technology pedagogy in order to examine confidence in technology use by teachers.

It is commonly agreed that the use of technology has the potential to enhance teacher pedagogy (Arouri, 2013; Jamieson-Proctor & Finger, 2008; Voogt, Knezek, Cox, Knezek & Brummelhuis, 2011) and student learning (Dutton, 2012; Ertmer & Ottenbreit-Leftwich, 2013; Kozma, 2003; Masango, 2014). According to Hughes (2005, p. 281), there are "three categories of technology supported pedagogy: technology functioning as (a) replacement, (b) amplification, or (c) transformation".

Replacement technology supported pedagogy does not necessarily change teaching strategies, goals or student learning. Rather the technology becomes the tool to reach the same learning goal that could be achieved in the absence of a digital device.

Amplification technology is about doing things more efficiently. According to Hughes (2005) both technology as replacement and technology as amplification sustain current teaching practices as opposed to providing the innovative learning for which digital technology is designed. It is only when the technology is used to challenge student learning and cognitive thinking along with changing teachers' current pedagogical methods, that technology becomes transformative. These three categories describe the potential pedagogical impact that technology can facilitate, with the transformative category leading to enhanced teacher pedagogy and student learning.

Like most aspects of technology, understanding its use in the classroom is an evolving concept. For this study, drawing from the elements described above, technology use in the classroom was defined as teachers' use of technology resources including software and hardware (Bharati, 2014; Dawson, 2008; Dutton, 2012; Hennessy, Ruthven & Brindley, 2005; Masango, 2014; Peters, 2007) in order to provide innovative pedagogy that leads to relevant and transformational learning for students (Hughes, 2005; Ertmer & Ottenbreit-Leftwich, 2013). As users of technology in the classroom, both the teacher and student reformulate knowledge to creatively produce information with digital devices (Soujah, 2014).

2.2.2 Past research on technology use in the classroom

The study reported in this thesis examined the associations between teachers' confidence in the use of technology on burnout, self-efficacy and satisfaction. A review of the literature on technology use by teachers has revealed two themes that are relevant to teacher confidence: the increasing presence of technology and the importance of professional development.

As this study focused on teachers' confidence with technology use, it is helpful to review literature on the increased integration of technology in the classroom. Integration of technology is defined as the reliance on computer technology for lesson delivery (Bauer & Kenton, 2005) and includes the presence of digital devices such as, laptops, tablets and smartboards that teachers use in the classroom. The compulsory integration of technology use in schools by students and teachers has been developing in Australia since the mid-1980s. The Common and Agreed National Goals for

Schooling (AEC, 1989) are recognised as an early platform for identifying technology skills and how schools were managing technology (Baskin & Williams, 2006). Integration of technology in the classroom requires the teacher to design innovative learning experiences for which technology is used as an essential tool in order for the student to complete tasks.

In an early critique of understanding technology innovation in the classroom, Zhao, Pugh, Sheldon and Byers (2002) identified factors that facilitate or hinder the use of technology in the classroom by teachers. They concluded that expecting dramatic changes to the way teachers delivered lessons because of technology was not realistic. Instead, an evolutionary approach to lesson design is needed. Kimber, Pillay and Richards (2013) coined the phrase technoliteracy to describe technology skills and practices needed for teachers to move from an industrial age to a knowledge age approach to learning. In response to the Digital Education Revolution (DER) policy, White (2008) explored the complexity and speed of technological growth and trends occurring in technology in Australia. He acknowledged the ongoing evolution of technology in the classroom and posed the question "what about the capacity of people and institutions to adapt?" (White, 2008, p. 14). The elements described expose some of the difficulties (barriers) faced by teachers as use technology in the classroom.

Hew and Brush, (2007) examined the general barriers to the integration of technology for instructional purposes in schools. Whilst their research was extensive, it focused on digital technology use for instructional purposes rather than on the broader concept of pedagogy. However, their study provides identification of six barriers that prevent technology use: "knowledge and skills; institution; attitudes and beliefs; assessment; and subject culture" (Hew et al., 2007, p. 226).

Even though barriers exist, technology integration is deemed fundamental to achieving excellence in pedagogy and curriculum design (Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur & Sendurur, 2012). Barriers to technology confidence were predicted long before the DER Policy (White, 2008). Ertmer (1999) urged educators to develop the skills needed to overcome what she describes as first-order, extrinsic barriers and second-order, personal barriers. Hew et al. (2007) used the first-order and second-order barriers described by Ertmer (1999) to group their six categories according to first-

order obstacles (external to teachers) and second-order obstacles (intrinsic to teachers). First-order obstacles include resourcing such as equipment, training and time. Second-order obstacles refer to teachers' beliefs about teaching and learning and technology. Whilst the two orders are inextricably linked (Hew et al., 2007), it is the two second-order barriers that relate directly to the investigation reported in this thesis which specifically examined teachers' confidence and self-efficacy (belief) along with knowledge and skills to use technology with students.

A number of studies have provided strategies to overcome confidence barriers (Ertmer, 1999; Ertmer et al, 2013). In particular, teacher training, including school-led professional development, is considered a successful strategy to overcome barriers of technology integration (Hew et al., 2007).

Providing relevant, collaborative and collegial professional development significantly influences the success of technology integration by teachers. When teachers are able to share their knowledge in nonthreatening professional learning communities, they are more likely to succeed with technology integration (Robertson, Fluck, Webb & Loechel, 2004). As early as 1988, when Woodhouse and Jones identified that teachers had little or no knowledge of how to operate computers in order to deliver their coursework, they recommended that teachers' lack of knowledge about computing be addressed through relevant teacher training. Since that time, much literature has examined the professional learning needs of teachers as they integrate technology into their classes (see, for example, Keller, Bonk, & Hew, 2005; MacDonald, 2008; Wei, Darling-Hammond, Andree, Richardson, & Orphanos, 2009). Lawless and Pellegrino (2007) argue that the provision of effective professional development is 'critical' to teachers successfully adopting new technologies. The features of effective technology professional development identified by Kanaya, Light and McMillan Culp (2005) are intensive, invitational training directed at teacher interests is likely to be successful. This success inevitably leads to increased confidence with using technology in the classroom.

The next section of this chapter provides a review of literature on the four main constructs investigated in this study: Teacher confidence (Section 2.3); Teacher

burnout (Section 2.4); Teacher self-efficacy (Section 2.5); and Teacher satisfaction (Section 2.6).

2.3 Teacher Confidence

This section reviews literature related to teacher confidence. My review of literature indicated that, because the field of teacher confidence is vast, it was necessary to constrain the review to only information that was pertinent to the study reported in this thesis. This section commences by providing a definition of teacher confidence (Section 2.3.1) and then goes on to review past research within the field of teacher confidence (Section 2.3.2). This section concludes with a review of instruments developed to measure teacher confidence (Section 2.3.3).

2.3.1 Defining teacher confidence

Researchers in various disciplines have found the concept of self-confidence worthy of study. As a characteristic that influences behaviour (Oney & Oksuzoglu-Guven, 2015), self-confidence must be considered a significant personal attribute for teachers. Oney et al. (2015) argue that an agreed definition of the concept must be obtained if there is to be a unified theory of self-confidence. To this end, the authors provide a review of the literature pertaining to confidence including defining confidence. As a way of introduction, attention is drawn to the genesis of the word confidence, through the work of Rotenstreich (1972) who defines the term by tracing its Italian (*fiducia* – faithfulness) and Greek (*peitho* - persuasion) origins. Oney et al. (2015) then describe the work of several authors by grouping confidence definitions according to their similarities: confidence as judgement; confidence as conviction and/or certainty; confidence as evaluation; confidence as belief; and confidence as feeling, opinion and/or expression. Table 2. 1 provides, for each type of confidence, a definition and the author who proposed the definition.

Whilst the framework provided by Oney and Oksuzoglu-guven (2015) was developed outside of the discipline of education, it demonstrates the complexities in describing confidence as an attribute. Furthermore, it was used to distinguish the strand of confidence applicable for the research presented in this thesis. Because neither

confidence as judgement nor confidence as evaluation (see Table 2. 1) adequately met the definition required for the research reported in this thesis, the definition for confidence was drawn from those related to confidence as conviction and or certainty, belief and feeling, opinion and/or expression.

Confidence can be defined as a person's certainty about whether he or she will succeed and his or her ability to do so (Stankov, Lee, Luo & Hogan, 2012). Based on this definition, according to Stankov et al. (2012, p. 747), confidence is "a state of being certain about the success of a particular behavioural act". This assertion contributes to the definition used for this research as it highlights confidence in the ability to recognise knowledge and skill in oneself. For the purpose of this research, confidence is defined as the sense of conviction one has in the ability (knowledge and skills) to achieve success.

Table 2. 1 Definitions of Confidence – (Oney & Oksuzoglu-guven, 2015, pp. 151-152)

Confidence as:	Definition	Author
Judgement	• A person's judgement of certainty about a future event or outcome.	Barbalet (1998, p. 83)
	• An attribute of a judgement.	Berger (1992, p. 106)
Conviction and/or certainty	• The degree of conviction or certainty with which beliefs or attitudes are held.	Krishnan & Smith (1998, p. 276)
	• A subjective sense of conviction or validity regarding oneself.	Petty, Brinol, & Tormala (2002, p. 724)
	• The conviction that everything is under control and uncertainty is low.	Siegrist, Gutscher, & Earle (2005, p. 148)
	• A certainty about handling something.	Stajkovic (2006, p. 1208)
	• Degree of certainty individuals possess about their abilities.	Vealey (1986, p. 222)
Confidence as evaluation	• An inferential evaluation process based on available cues and on meta-cognitive beliefs about the relationships of these cues to memory accuracy.	Brewer, Sampaio, & Barlow (2005, p. 618)
	• A reliance stemming from persuasion or accompanied by it.	Rotenstreich (1972, p. 348)
	• The specification of risk through the calculation of probabilities arising under different conditions. Indeterminacy is rendered calculable and predictable at identified levels of confidence.	Smith (2005, p. 312)
	• An evaluative process based on the evidence collected from the past and the present ... that a chosen course of action will lead to a desire outcome.	Stankov, Crawford, Lee, & Paek (2009, p. 123)
Confidence as belief	• The belief, based on experience or evidence (e.g., past experience), that certain future events will occur as expected.	Earle (2009, p. 786)

Confidence as feeling, opinion and/or expression	• A feeling of assuredness and lack of anxiety.	Compte & Postlewaite (2004, p. 1539)
	• A favourable opinion that is linked to a subjective probability; this may be an estimation or a probability of argument.	Guennif (2002, p. 18)
	• One's overt expression of a likelihood.	Koehler (1991, p. 503)

Modified with permission from Oney and Oksuzoglu-guven, 2015

In reviewing the literature on teacher confidence (as opposed to confidence in general), specifically with respect to technology use, a range of terms have been used, such as: confidence in ability (Ross, Hogaboam-Gray & Hannay, 1999); confidence and frequency of use (Goos & Bennison, 2006); increasing confidence (Ertmer & Ottenbreit-Leftwich, 2010) and confidence as an internal barrier (Ertmer, 1999). Drawing on the definition of confidence described above, teacher confidence was defined, for the purpose of this study, as the sense of conviction (Petty, Brinol, & Tormala, 2002) that the teacher has in his or her ability to successfully use technology in the classroom (Stankov et al., 2012).

The study reported in this thesis examined teachers' confidence in both their knowledge of ICT and their skills to use ICT effectively. According to Mishra and Koehler (2008) Technology (ICT) knowledge includes knowledge about all technologies from books and blackboards to the more sophisticated technologies including the internet and digital devices. Technology (ICT) skills includes knowing how to manage hardware, software, operating systems, specific programs such as email and word processing and staying up to date with latest technologies (Mishra et al., 2008). Given this, teachers' confidence in technology includes both their confidence in their knowledge of technology and their confidence in their technology skills which in the course of teaching, would be combined with content and pedagogical knowledge (Mishra & Koehler, 2006; Mishra, Koehler & Kereluik, 2009).

2.3.2 Past literature on impact of teachers' confidence on technology use

Given the definition of confidence that was used to guide the research reported in this thesis (e.g. the sense of conviction that one has in the ability (knowledge and skills) to achieve success), understanding confidence with technology (ICT) has been

understood as the pedagogical knowledge and pedagogical skills required to achieve success with technology. The factors that impact the success in past studies include sex and teaching experience (sometimes identified as age). Given that these two factors were relevant to this study, literature related to sex and teaching experience are reviewed below.

2.3.2.1 Teacher sex differences and technology use

There are a number of studies that have examined differences between the confidence of males and females with respect to using technology (Broos, 2005; Cai, Fan & Du, 2017; Jamieson-Proctor & Finger, 2008). Whilst the studies all report similar findings, in regards to teachers' confidence with ICT, there are inconsistencies with respect to the focus of the various studies and technology use. For example, several studies have examined whether differences in sex, with respect to ICT use, existed in terms of anxiety. In many of these studies, males reported lower levels of anxiety with technology use than females (Broos, 2005; Tsai, Lin & Tsai, 2001; Schumacher & Morahan-Martin, 2001; Shashaani & Khalili, 2001). On the other hand, a meta-analysis by Cai et al. (2017) of sex differences in terms of attitudes indicated that, overall, males demonstrated more positive attitudes towards their ability to effectively learn and use technology. They also found that the attitudes of females were positive (not negative) despite being less positive than male attitudes. The meta-analysis reported by Cai et al. (2017) indicates that, despite the growth in technology use, females continue to have a less positive attitude towards its use than do males.

In another study, Jamieson-Proctor et al. (2008) examined teacher confidence and the frequency of ICT use by students. Their study of 2652 teachers revealed a significant relationship between teacher gender and student use of ICT. Relevant to this study was their finding that male teachers were more confident and, therefore, used ICT more often with their students than did females. Given that females make up approximately 70% of the teaching population, it is concerning that a greater number of students are being taught by teachers with less confidence in technology use (Jamieson-Proctor et al., 2008).

These studies are important as they add to the literature on how male and female teachers' confidence with ICT impacts use. However, a key problem with the studies previously described is the inconsistency by which teachers' confidence with technology use is examined (anxiety, attitude and frequency of use). Nevertheless, the literature consistently points to greater confidence held by males than females in regards to using technology. The study presented in this thesis adds to the literature on sex differences and teachers' confidence with digital technology specifically for Australian teachers.

2.3.2.2 Teacher experience

The literature on teacher experience indicates that there is a relationship between teachers' confidence with ICT use (knowledge and skills) and teaching experience (Broos, 2005; Peralta & Costa, 2007; Russell, O'Dwyer, Bebell & Tao, 2007; Saltan & Arslan, 2017). There is, however, some inconsistency with the definition of the concept of experience, with different authors referring to different aspects, such as: years of teaching experience (Alazam, Bakar, Hamzah, & Asmiran, 2012; Saltan et al., 2017; Russell et al., 2007); pre-service teachers and in-service teachers (Saltan et al., 2017); length of experience with using technology (Broos, 2005); and age of teachers (Lau & Sim, 2008). Given these differences, it is not surprising that the findings reported are mixed.

Saltan et al. (2017) examined the relationship between teachers' teaching experience and their self-confidence with respect to technological, pedagogical, and content knowledge. Comparing in-service and pre-service teachers, they found that teachers with different amounts of teaching experience differed significantly in their technological knowledge. That is, teachers with 20 years of experience reported having less technological knowledge confidence than teachers with 6 to 15 years of experience. Despite the assumption that in-service teachers would have more experience with technology use than pre-service teachers, the overall confidence scores were not significantly different for the two groups. Alazam et al. (2012) also found that teachers with less years of experience held more advanced ICT skills than those teachers with more years of experience.

The findings reported above were different from those of Peralta et al. (2007) who found that teachers with more experience had greater confidence with technology. However, their research does not provide a framework for understanding the concept of experience, leading to some ambiguity with the use of the term. Contrary to Alazam et al. (2012), when Lau and Sim (2008) investigated ICT adoption by teachers in Malaysia, older teachers were found to be more likely to use technology than younger teachers. They suggest this might be attributed to sound skills, good knowledge and level of confidence with technology.

Another teaching experience study, which is limited by the absence of confidence, was conducted by Russell et al. (2007). Despite the absence of confidence, their study found some complex results including: student use of technology was more frequent for teachers with less than ten years' experience; and teachers with teaching experience greater than 15 years used technology less for lesson planning and communication. Broos (2005) undertook a study on an attitude with years of experience and found that attitudes to computer use differ for males and females, with males reporting a more positive attitude. However, this study was limited by its absence of confidence.

The findings described above are inconsistent and suggest that teaching experience is not a clear predictor of teachers' confidence with using technology. The research presented in this thesis adds to the literature on teaching experience with ICT by defining experience according to age.

2.3.3 Instruments for measuring confidence

Because the present study examined teachers' confidence in using ICT, a review of literature was undertaken to identify a suitable instrument. This section provides an overview of past instruments that have been developed to measure confidence.

The Technology Acceptance Model (TAM), uses the two variables of perceived usefulness and perceived ease of use, along with the relationship between system and potential system use, to explain individual behaviour towards technology use (Marangunić & Granić, 2015). As a measure of technology acceptance, TAM has been scrutinised (see, for example, Chang, Lieu, Liang, Liu &Wong, 2012; Marangunić &

Granić, 2015; Venkatesh, Morris, Davis & Davis, 2003) and criticised (Venkatesh & Davis, 2000). TAM provides a framework to predict acceptance and usage of technology (Venkatesh et al, 2003) and "explains individual technologies acceptance decisions across a wide range of technologies" (Chang et al., 2012, p.103). Decision confidence in task complexity has been linked with acceptance and usage of technology explored in the Technology Acceptance Model (Davis, 1985).

Chang et al. (2012) proposed a modification of the TAM to create a causal model to investigate technology acceptance by teachers based on perceived usefulness and perceived ease of use. Chang and colleagues examined the usefulness and ease of use of a new technology, namely, overhead projector (digital). The scales used included: perceived usefulness, perceived ease of use, using intention, computer self-efficacy, subjective norms, compatibility and job relevance. A five-point Likert scale ranging from strongly agree to strongly disagree was used. Whilst the items in this study included: *It was easy for me to become skilled at using an overhead projector,* and *Whenever possible, I intend to use overhead projector while teaching,* there was no use of the word confidence in any item. I was attracted to the method of measurement and ease of use in this model. However, because the model did not provide a measure of knowledge and skills confidence, this instrument was not included in this study.

The Technology and Teaching Efficacy Scale (TTES), developed by Mayo, Kajs and Tanguma (2005) and validated by Tanguma, Underwood and Mayo (2004), was used by Willis, Weiser and Smith (2016) to examine increasing teacher confidence in technology use. Whilst the focus of the survey was to assess teachers' perceived confidence to use technology, it involved language that is commonly associated with self-efficacy. Specifically, the items began with the phrase, *I believe*. For example: *I believe my students will be able to learn better because I will be able to incorporate technology into their activities; I believe I will be able to use technology to capture a student's interest; and I believe I will be perceived as an asset to my school.* The 22 items of the instrument are rated on a 5-point Likert Scale ranging from strongly disagree to strongly agree. Although used by Willis et al. (2016) to assess technology confidence, the TTES seems to be more a measure of self-efficacy, and therefore it was not used for the present study.

The only other instrument found to assess teachers' confidence with ICT was the Technology Pedagogy Content Knowledge (TPACK) Confidence Survey (Albion, Jamieson-Proctor & Finger, 2010; Finger, Jamieson-Proctor, Cavanagh, Albion, Grimbeek, Bond, ... & Lloyd, 2013; Jamieson-Proctor, Albion, Finger, Cavanagh, Fitzgerald, Bond & Grimbeek, 2013; Koehler, Shin & Mishra, 2012; Mishra & Koehler, 2006). The TPACK framework conceptualises teacher content knowledge, pedagogical knowledge and technological knowledge as three core domains of curriculum design and professional learning (Jamieson-Proctor et al., 2013). The TPACK Survey was designed to include pre-service teachers and was made up of 24 items measuring two factors: confidence and usefulness. Specifically, the stem for each item of the confidence scale read: *How confident are you that you have the knowledge, skills and abilities to support students' use of ICT to …* The instruments' psychometric measurement of the TPACK Survey has been extensively evaluated. It has a sound conceptual basis and can be adapted for new and emerging technologies (Jamieson-Proctor et al., 2013). This instrument was selected for my study as it provided the means to assess teachers' confidence in using technology in the classroom. Chapter 3 provides details about the instrument and how it was modified for use in this study.

2.4 Teacher Burnout

The final aspect of my study was teacher burnout. This section begins by defining teacher burnout (Section 2.4.1) and then examines literature related to teacher burnout (Section 2.4.2). Literature related to the relationship between burnout and technology use is then examined in section 2.4.3 and technology use by teachers and burnout is discussed in section 2.4.4. This section concludes with a review of the instruments that have been developed to assess teacher burnout (Section 2.4.5).

2.4.1 Defining teacher burnout

Christina Maslach (1982) is consistently cited as the most significant contributor to defining and researching burnout (see, for example, Goddard & Goddard, 2006; McCormick & Barnett, 2011; Neumann & Finaly-Neumann, 1991; Sarros & Sarros, 1987). Moving from its original definition (a negative state of mind) burnout has been

re-defined by Maslach and Leiter (1997) as an erosion of engagement, involvement and efficacy (Schaufeli, Leiter & Maslach, 2009). According to Maslach, Jackson, and Leiter (1996), burnout syndrome has three distinct but loosely coupled dimensions: emotional exhaustion (feelings of being emotionally overextended and exhausted with one's work), depersonalization (the development of negative and uncaring attitudes towards others) and negative personal accomplishment (the loss of feelings of self-competence and dissatisfaction with one's achievements). Goddard et al. (2006) define the term burnout as an accepted syndrome that explains exhaustion physically, emotionally and cognitively that comes about from sustained exposure to situations that are emotionally demanding. Burnout syndrome is particularly experienced by people who work in emotionally charged social situations (Schwarzer & Hallum, 2008).

For the purpose of this study and based on the definition provided by Maslach et al. (1996), burnout was defined as emotional exhaustion, depersonalisation and negative personal accomplishment experienced by teachers.

2.4.2 Past research on teacher burnout

Teacher burnout is considered a serious and important issue (Brouwers & Tomic, 2000) and is evident at both personal and organisational levels (Dorman, 2003). At both levels, teacher burnout is associated with stress (see, for example, Mearns & Cain, 2003; Skaalvik & Skaalvik, 2010). According to McCormick et al. (2010), personal teacher stress stems from factors such as student behaviour. For example, teachers who join the profession expecting to be instrumental in shaping the minds and futures of adolescents could be disillusioned due to student behaviour that does not permit their expectations to be fulfilled (McCormick et al., 2010). Occupational stress stems from factors such as: diversity of tasks and professional recognition (Mearns et al., 2002). Further to this, organisational stress is likely to stem from excessive class sizes, poor resources and vague rules, along with lack of privacy (Muriithi & Karanja, 2018). Given these origins of stress, it is widely recognised that a build-up of stress is the leading cause of teacher burnout (Arvidson, Hakansson, Karlson, Bjork & Peterson, 2016; Betoret, 2006; Haberman, 2005; Muriithi et al., 2018)

Brouwers et al. (2000) demonstrated a link between teacher burnout and self-efficacy. They measured the perceived self-efficacy of teachers along with the three dimensions of burnout: emotional exhaustion, depersonalisation and personal accomplishment. They concluded that self-efficacy in classroom management affects both the depersonalisation and personal accomplishment dimensions of burnout. Similarly, Schwarzer et al. (2008) argue that teacher burnout is associated with teachers who demonstrate low self-efficacy and low coping resources. They propose that an inability to cope contributes to the burnout dimension of emotional exhaustion.

Emotional exhaustion is considered to be a central element of burnout (Maslach, Schaufeli & Leiter, 2001). The burnout domains of exhaustion and disengagement are associated with high workload experienced by teachers (Maslach et al., 2001). Equitable distribution of teacher workload along with teacher collaboration are considered key elements in avoiding teacher burnout (Timms, Graham & Cottrell, 2007). Likewise, job satisfaction, role clarity and job challenge are considered to be predictors of potential teacher burnout (Sarros & Sarros, 1987), whereas job satisfaction and belonging being indirectly related to emotional exhaustion (Skaalvik et al., 2010).

Muriithi et al. (2018) examined the blame attributed to teachers for educational shortcomings resulting in stress, teacher overload and burnout. Stress build-up, leading to burnout, and the impact of social support on the teacher's ability to cope were examined. The study suggested that social support is a resource for coping with burnout. In another study, when Hoogendijk, Tick, Hofman, Holland, Severiens, Vuijk and van Veen (2018) examined how a teacher coaching program impacted on teachers' emotional exhaustion, a decrease in feelings of emotional exhaustion occurred during the teacher intervention. In my review of the literature related to teacher confidence, professional development (teacher workshops, mentoring and learning communities) has consistently been linked to reducing burnout.

Despite the level of stress that teachers encounter, most have successful strategies to manage the stress before reaching the stage of not coping and burnout (Skaalvik et al., 2011). However, this might not be the case for beginning teachers who have

experienced coping problems and burnout that are associated with intentions to leave the industry (Goddard et al., 2006).

Whilst the studies presented above provide insight into teacher burnout across several areas, my study involved how burnout is related to teachers' confidence with using ICT. Therefore, the instrument I used to assess teacher burnout (described in Chapter 3) included items to assess emotional exhaustion, depersonalisation and personal accomplishment.

The following section provides a review of literature related to burnout in technology-using. What appears missing from the literature is research specifically related to teacher burnout and technology use. Therefore, this section further provides literature that supports the hypotheses of this study that burnout is related to teachers' confidence in technology use.

2.4.3 Technology use and burnout

Burnout has traditionally been associated with people who work in the helping professions (Schaufeli, Leiter & Maslach, 2009). However, in the twenty-first century, other professions have been identified as potentially contributing to burnout, including professions involved with the fast-paced world of technology (Hetland, Sandel & Johnsen, 2007). Technological transformation has accelerated productivity, with ICT personnel working faster and harder, despite personal limitations (Evenstad, 2018). According to Evenstad (2018), technology use includes email, text and other instant messaging, which lead to an increase in communication, interaction, knowledge and information, which all impacts the wellbeing of the user of technology.

Hetland et al. (2007) investigated the impact of leadership on burnout among ICT workers. They described ICT workers as meeting the burnout potential criteria of personally engaged, fast-paced, deadline-driven and competitive working environments. This is supported by Evenstad (2018) who concluded that ICT workers enhance the efficiency and effectiveness of organisations because of their ability to be flexible, responsive and agile. They add, however, that the demand for these traits leads to burnout, which arguably leads to reduced job performance, attrition from the

profession and reduced physical wellbeing (Pawlowski, Kaganer, & Cater, 2007). This supports the findings of Ter Hoeven, van Zoonen and Fonner, (2016) that the advantages and disadvantages of technology are equal in terms of burnout.

2.4.4 Technology use and teacher burnout

Despite the research related to burnout among ICT workers, there is a dearth of literature related to burnout as experienced by teachers using technology. Technology-using employers have identified levels of stress and burnout amongst their employees (Evenstad, 2018; Hetland, et al., 2007). Therefore, it is reasonable to suggest that teachers' use of technology could lead to the same experiences of burnout. Given that the literature on teacher burnout (along with the literature on technology using professions and burnout) consistently point to three dimensions of burnout theory, I hypothesised that the increased demand on teachers to use technology would lead to the three dimensions, emotional exhaustion, depersonalisation and (low) personal accomplishment as suggested by Maslach (1982).

The introduction of technology into the classroom was imposed (Hennessy, Ruthven & Brindley, 2007) at a rapid rate that required teachers to learn and unlearn (OECD, 2015), therefore contributing to a school climate of depersonalisation because of lack of voice and feelings of being unnoticed (Haberman, 2005). The expectation that teachers would use technology came from governments, governing bodies and school administration, thus leading to a lack of workplace control which contributes to all three dimensions of burnout (Rupert, Miller & Dorociak, 2015).

Technology was introduced into schools in various forms (laptop, smart board and tablets) and with fast increasing capabilities (Cai, Fan & Du, 2017). Teachers were expected to confidently use the devices and change their pedagogy to suit the relevant technology despite any reluctance. In particular, teachers with a strong teacher-centred approach to learning were found to be low technology uses, expressing a fear of technology (Kimber, Pillay & Richards, 2002).

Given the dearth of literature on relationships between teacher burnout and use of ICT, the study presented in this thesis filled this overdue gap.

2.4.5 Instruments for measuring burnout

Instruments to assess teacher burnout include: the Oldenburg Burnout Inventory (OLBI) (Demerouti, Bakker, Vardakou & Kantas, 2003); the Copenhagen Burnout Inventory (Kristensen, Borritz, Villadsen & Christensen, 2005); the Maslach Burnout Inventory (MBI) (Maslach, 1982; Maslach & Jackson, 1986).

The Oldenburg Burnout Inventory (OLBI) is described by Demerouti, Bakker, Vardakou and Kantas (2003) as assessing exhaustion and disengagement. The OLBI is made up of negatively-worded and positively-worded items in order to assess both ends of the burnout continuum, for example, exhaustion and vigour and disengagement and dedication (Demerouti et al., 2003). The reliability and validity of the OLBI were reported by Halbesleben and Demerouti (2005) for data from 2599 participants in the United States. The reliability was generally acceptable with Cronbach alpha coefficients above .70. In addition, a two-factor model (exhaustion and disengagement) was identified as the best fit for the OLBI data. According to Halbesleben (2005), one significant difference between the OLBI and other instruments is that it measures a broader range of burnout experiences, including emotional, cognitive and physical burnout. Whilst the OLBI has some appealing aspects, limited research and use of the inventory made it unsuitable for this study.

The Copenhagen Burnout Inventory (CBI) was developed as an alternative burnout instrument by Kristensen, Borritz, Villadsen and Christensen (2005), who reported satisfactory validity and reliability for the CBI. The three scales of the CBI (personal burnout, work-related burnout, client-related burnout) included a total of 19 items that were responded to using a five-point Likert scale. The survey was administered to 1914 participants from various types of workplaces. Whilst this study supported researchers who aimed to "criticize the MBI on a number of points and present a new tool for measurement of burnout" (Kristensen et al., 2005, p.192), it was not selected for the present research presented in this thesis because it had been used mostly in the health professions

Maslach and Jackson's (1981) Maslach Burnout Inventory has been cited by numerous authors including: Dorman (2003); Goddard and Goddard (2006); McCormick and

Barnett (2011); Neumann and Finaly-Neumann (1991); Sarros and Sarros (1987); Schaufeli, Enzmann and Girault (1993); Schaufeli, Leiter and Maslach (2009); and Timms, Graham and Cottrell (2007). Psychometric analyses (Schaufeli et al, 1993) showed that the inventory of the MBI had high reliability and validity. Despite the criticism of the MBI and the proposed alternatives (including the OLBI and CBI), the MBI was the inventory of choice for my study.

The Maslach Burnout Inventory (MBI) assesses the three sub-scales of burnout of Emotional Exhaustion, Depersonalization and Personal Accomplishment (Schaufeli, Leiter, and Maslach, 2009). According to Schaufeli and Enzmann (1998), the MBI was the dominant instrument cited in journals by the end of the 1990s. The inventory was used firstly in the human service industry and later with teachers. The MBI is made up of 22 positive and negative items that are responded to using a six-point frequency scale ranging from *Never* through to *Every Day*. Examples of items include: *I feel emotionally drained from my work; I feel burned out from my work; I have accomplished many worthwhile things in this job* (Maslach & Jackson, 1986).

The MBI was modified for my study to include all three dimensions with a greater focus on emotional exhaustion. Given the widespread use of the MBI in studies of teacher burnout (see, for example, Arvidsson, Håkansson, Karlson, Björk & Persson, 2016; Brouwers & Tomic, 2000; Goddard & Goddard, 2006; Skaalvik & Skaalvik, 2010) the modified version of the MBI was used in this study to measure teachers' emotional exhaustion, depersonalisation and personal accomplishment.

2.5 Teacher Self-efficacy

There is some overlap between the literature on confidence and the literature on self-efficacy, with Bandura (1986, 1997, 2001) contributing significantly to defining self-efficacy. This next section firstly defines self-efficacy (Section 2.5.1), and then provides an examination of past research on self-efficacy (Section 2.5.2). This section concludes with a review of instruments for measuring self-efficacy (Section 2.5.3).

2.5.1 Defining self-efficacy

According to Guskey (1987) the earliest work on efficacy can be attributed to Heider (1958) and White (1959) with Bandura (1977, 1986, 1991, 1997, 2001, 2006) becoming arguably the master of defining and measuring self-efficacy. Bandura (1986, 1997) describes four sources of self-efficacy: mastery experiences; vicarious experiences; social/verbal persuasion; and physiological emotional states. Mastery experiences are considered to be the most significant sources of self-efficacy (McCormick, Ayres & Beechey, 2006; Tschannen-Moran, Hoy & Hoy, 1998) because they are based on prior personal experience of perceived success or failure. Vicarious experiences are based on observations of successful role models (Smith, 2001), mentors or experienced professionals (McCollum & Kajs, 2007). The strength of social/verbal persuasion depends on the credibility and expertise of the persuader (Bandura, 1986). A credible persuader has the power to convince others of their capabilities (Pfitzner-Eden, 2016). However, when given loosely and unauthentically the persuader might not be as effective (Hendricks, 2016). The weakest of the sources of self-efficacy, physiological and affective state (McCormick et al., 2006), influences the sense of personal ability based on both positive and negative physical arousal. Understanding the four sources of self-efficacy (Bandura, 1986, 1997) contributes to my study of the relationship between confidence and self-efficacy.

Self-efficacy is described within Bandura's social cognitive theory (Bandura, 1991, p. 257) as "people's beliefs about their capabilities to exercise control over their own level of functioning and over events that affect their lives". Perceived self-efficacy is "beliefs in one's capabilities to organise and execute the courses of action required to produce given attainments" (Bandura, 1997, p. 3). Bandura expands this by describing levels of perceived self-efficacy:

> Level of perceived self-efficacy is defined in terms of whether a person's self-judged efficacy is limited to simple tasks, whether it extends to moderately difficult ones, or whether it includes even the most taxing performances within a particular domain of functioning. (Bandura, 1986, p. 369)

As a future-oriented belief (Tschannen-Moran, Hoy & Hoy, 1998), self-efficacy is how individuals think about their level of competency in any situation. Subsequently, success and personal well-being are enhanced when people have a high perceived level of efficacy, approaching challenging tasks with the assurance that they are in control and ready to master (Bandura, 1994). However, as Tschannen-Moran et al, (1998, p. 211) point out, a high (or low) level of self-perception of competence does not necessarily equate to actual level of competency and can affect actions and efforts accordingly.

For the purpose of this, study self-efficacy was defined as the belief an individual has in the ability to achieve a level of competency towards technology use.

Bandura's (1986) social cognitive theory is extensively drawn on by researchers of self-efficacy specifically related to teachers (Aldridge & Fraser, 2016; Lemon & Jarvis, 2016; O'Neil & Stephenson, 2011; Tschannen-Moran, et al., 1998; Willis, Weiser & Smith, 2016) and draws attention to the conceptualisation of teacher self-efficacy as a concept in its own right. The next section (Section 2.4.2) describes teacher self-efficacy.

2.5.2 Self-efficacy or teacher self-efficacy

On the one hand, teacher efficacy is described by Tschannen-Moran et al, (1998, p. 233) as belief in the ability to successfully execute specific teaching tasks and content. However, Lemon et al. (2016) differentiate between teacher efficacy and teacher self-efficacy. They propose that teacher efficacy relates to beliefs about learning situation, while teacher self-efficacy relates to the set of beliefs that the teacher holds about his or her capacity to undertake educational instruction which leads to positive student outcomes. Similarly, Zee and Koomen (2016) suggest that an assured sense of teacher-self efficacy sets the tone for high quality, meaningful learning that influences both student and teacher outcomes. The definitions of teacher self-efficacy, provided by Lemon et al. (2016) and Zee et al. (2016), are supported by a number of authors (see for example, Aldridge & Fraser, 2016; Pfitzner-Eden, 2016; Tschannen-Moran & Hoy,

2001; Woolfolk, in Shaughnessy, 2004). Teacher self-efficacy was the focus of this research.

Given that self-efficacy is considered an important factor in teacher success in the classroom (Ross, Hogaboam-Gray & Hannay,1999; Sang, Valcke, van Braak & Tondeur, 2009), it is worth reviewing factors that influence self-efficacy. Bandura's (1997) four sources of efficacy have been used by a number of authors (McCormick et al., 2006; Pfitzner-Eden, 2016; Wang, Ertmer & Newby, 2004) specifically to understand influences on teacher self-efficacy. The cognitive processing of mastery experiences, vicarious experiences, verbal persuasion and physiological and affective states (Bandura, 1997) influences self-efficacy. For example, in line with Bandura's (1997) description, verbal persuasion in the form of positive feedback (Pfitzner-Eden, 2016), phrased as achievement towards a standard, and from mentor teachers, positively influences pre-service teachers' self-efficacy. Negative physiological and affective states have been found to impact mastery experiences by contributing to a decrease in self-efficacy (Pfitzner-Eden, 2016). Whilst other studies (Wang et al., 2008; Willis, Weiser & Smith, 2016) have found that vicarious learning experiences contribute to increased self-efficacy, this was not the case for Pfitzner-Eden (2016) who reported that vicarious experiences did not influence pre-service teachers' self-efficacy. This is in contrast to Wang et al. (2008) who described vicarious learning experiences as a direct benefit to pre-service teachers. Albion (1999) argues that self-efficacy theory suggests that real experiences have greater influence on self-efficacy than vicarious experiences. This is supported by Tschannen-Moran et al. (2001) who notes that self-efficacy would be positively influenced (for pre-service teachers) by a gradual shift from vicarious experiences and verbal persuasion to mastery teaching experiences. Whilst there are some mixed findings, Bandura's (1997) four sources of self-efficacy contribute to the way researchers understand the factors that influence self-efficacy for teachers.

Research specifically related to self-efficacy and technology use (see, for example, Ross et al., 1999; Wang et al., 2008; Willis et al., 2016) is relevant to my study. According to Wang et al. (2004), successful technology integration in the classroom needs teachers with enhanced self-efficacy. Ross et al. (1999) suggest that teachers with high self-efficacy use teaching practices (cooperative learning, student-centred

activities, interdisciplinary teaching) that are needed for successful technology integration. As demonstrated by Ross et al. (1999), the most powerful influences on self-efficacy with technology are mastery experiences. Following an infusion of technology resources for teacher use, opportunities for teachers' success increased, which contributed to an increase in confidence with using the technology. In keeping with Bandura's four-source theory of self-efficacy, Wang et al. (2008) investigated the impact of vicarious experiences on successful technology integration and teachers' self-efficacy for technology use. Using a mixed factorial research design to assess the self-efficacy beliefs for technology integration among 280 pre-service teachers, Wang found that teacher self-efficacy was related to the successful integration of technology, which can develop teachers' confidence. Taking a different approach, Willis et al. (2016) specifically designed a course to help 424 teachers improve confidence with technology (tools, integration and teaching) and examined the confidence and self-efficacy of the teachers. Guided by the idea that observations are a powerful influence on self-efficacy during vicarious experiences (Bandura, 1997; Tschannen-Moran & Hoy, 2001), Willis et al. (2016) argued that technology training must be experiential to demonstrate uses of technology and mimic vicarious mastery experiences. Their results suggest that teachers' (perceived) technology integration self-efficacy increased during participation in an educational technology course. Willis did not identify a relationship between self-efficacy and confidence with technology use.

The studies reviewed above provide insight into aspects of self-efficacy and technology use by teachers that are pertinent to this thesis by identifying parameters by which self-efficacy can be understood, particularly through the work of Bandura (1997). Whilst self-efficacy and technology have been examined in past research there has been limited investigation of relationships between self-efficacy, confidence and technology use. Furthermore, past studies involved pre-service teachers. Because of limited research involving all three factors of confidence, self-efficacy and technology use, my study presented fills this gap.

2.5.3 Instruments for measuring self-efficacy

This section provides an overview of instruments for measuring self-efficacy. According to Bandura (1986), self-efficacy scales measure what people believe they

can do to complete a task rather. Bandura (2006) argues that efficacy is about capability and therefore all questionnaire items should be written using 'can do' as opposed to 'will do'. Items require pilot testing to ensure that they hold enough challenge to discern the measure of efficacy.

In their pursuit of providing a new measure of teacher efficacy, Tschannen-Moran and Hoy (2001) offered a useful overview of instruments used to measure teacher efficacy.

- Guskey's (1981) 30-item instrument measuring teacher efficacy and responsibility for student achievement (RSA)
- Rose and Medway's (1981) 28-item instrument called the teacher locus of control (TLC) which measures teacher responsibility for student success or failure. Tschannen-Moran et al. (2001) note that the TLC measure was not widely accepted.
- Ashton, Olejnik, Crocker, and McAuliffe's (1982) 7-item forced-choice Webb scale that extended the measure of teacher efficacy and reduced the problem of bias (p. 787). Tschannen-Moran et al. (2001) found no further published work using this measure.
- Ashton, Buhr and Crocker's (1984) instrument to measure context-specific efficacy. Using vignettes (50 items), teachers were asked to make judgements about their effectiveness to manage a situation through performance and a second version through comparison with other teachers. Tschannen-Moran et al. (2001) note that Ashton's vignettes were not widely used.
- Gibson and Dembo's (1984) teacher efficacy scale (TES), a 30-item 6-point Likert scale used to measure personal teacher efficacy (PTE) and general teacher efficacy (GTE). Tschannen-Moran et al. (2001) assert that statistical and conceptual challenges render the instrument problematic.

The factor structure of a Norwegian teacher self-efficacy scale (NTSES) was tested by Skaalvik and Skaalvik (2010). The 7-point scale was developed with Bandura's recommendations and included 24 items with six dimensions; "instruction, adapting education to individual student's needs, motivating students, keeping discipline, cooperating with colleagues and parents, and coping with changes and challenges" (Skaalvik & Skaalvik, 2010, p. 1061). The authors assert that following factor and

confirmatory factor analyses, "teacher self-efficacy should be treated as a multi-dimensional construct, but for research purposes it may be treated as a latent variable indicated by the six sub-scales" (Skaalvik et al., 2010, p. 1062). They further assert that this scale is especially valuable for research intentions. The NTSES closely follows the Bandura (2006) self-efficacy recommendations and bears similarities to my research. However, it was not selected following a closer examination of the items which had been translated from Norwegian to English (e.g. *Teachers in this school prevent mobbing effectively).*

According to Celik and Yesilyurt's (2013), perceived computer self-efficacy relates to both interest in and desire to use computers, along with a sense of determination to overcome computer related difficulties. The Perceived Computer Self-Efficacy Scale as developed by Askar and Umay (2001) was used by Celik et al. (2013) to measure the computer self-efficacy of 471 pre-service teachers. The single-factor 18-item scale included items beginning with *I think that I am able…*and *I believe that I have…* Because details of the 18 items were not provided, it was not considered for use in my research. Whilst computer self-efficacy is closely related to the present study, teacher self-efficacy was considered more pertinent to its aim.

The Bandura Teacher Efficacy Scale has 30 items with the 7 sub-scales of Efficacy to Influence Decision Making, Efficacy to Influence School Resources, Instructional Self-Efficacy, Disciplinary Self-Efficacy, Efficacy to Enlist Parental Involvement, Efficacy to Enlist Community Involvement, Efficacy to Create a Positive School Climate. This scale was considered useful for this study because it measured teachers' difficulties when using technology. The scale (described in more detail in Chapter 3) was modified for use in the present study.

2.6 Teachers' Satisfaction

This section reviews literature on teachers' satisfaction and ICT use. To begin with, teachers' job satisfaction is defined (Section 2.6.1). This is followed by a review of past research on teachers' satisfaction with ICT (Section 2.6.2). This section concludes with a review of the instruments to measure teacher satisfaction (Section 2.6.3).

2.6.1 Defining Teachers' satisfaction

Considerable research has been conducted on teachers' satisfaction with the seminal work of Herzberg, Mausner and Snyderman (1959) often being cited. Through an examination of industrial motivation, Herzberg et al. (1959) identified satisfaction factors and dissatisfaction factors for individuals. Satisfiers (satisfaction needs) are factors found within the work itself, whilst dissatisfiers (hygienic needs) are found in the environment of work. Herzberg et al. (1959) argues that hygienic needs are related to individual happiness and satisfaction needs have motivational potential. Inspired by Herzberg's (1959) two-factor theory, Sergiovanni (1967) undertook research on the relationship between the two factors. He concluded that satisfiers and dissatisfiers are mutually exclusive, with teachers gaining the most satisfaction from work-centred activities (satisfiers). Satisfiers, according to Dinham and Scott (1997), include intrinsic rewards such as achievement, attitude, behaviour, self-growth and positive relationships.

Job satisfaction requires the tempering or removal of dissatisfiers so that the individual's energies are not impacted by unsatisfactory work conditions (Sergiovanni, 1967). Contributing to this idea, Dinham et al. (1997) found that teacher resignation decisions were often based around dissatisfiers as opposed to satisfiers. Their research also identified a third band of influence on teachers' satisfaction, namely, school factors including leadership, climate, reputation and infrastructure.

Tsai, Huang, Wang, Chen, Pan, Wang … Chang (2016, p. 3) refer to Hoppock (1935) and Locke (1969) to define job satisfaction as "a person's overall attitude to his or her job". Locke (1969) defines satisfaction as both a product and a determinant (indirectly) of performance, with past satisfaction influencing the individual. This is supported by Wagh (2016) who defines job satisfaction as the pleasurable state following appraisal of the individual's job. Aldridge and Fraser (2016) add to these definitions by including both positive and negative evaluations made about an individual's job. Performance (Locke 1969), appraisal (Wagh, 2016) and evaluations (Aldridge et al., 2016) are factors related to defining how individuals judge satisfaction with their job.

A different approach to defining teaching satisfaction was taken by Ho and Au (2006) who suggest it is the association between what teaching has to offer and what the individual wants from the job.

The term satisfaction can further be understood by considering its counterpart, dissatisfaction. Dinham and Scott (1996, 1997) and Scott and Dinham (1999; 2003) have made significant contributions to the study of teacher satisfaction and dissatisfaction. For example, they report that teachers have the greatest sense of satisfaction towards intrinsic factors and the greatest sense of dissatisfaction towards extrinsic factors. Similarly, Sergiovanni (1967) identifies intrinsic factors (achievement, recognition and responsibility) as contributors to teacher satisfaction and conditions of work as sources of dissatisfaction. Likewise, Vroom (1964) defines job satisfaction by considering the degree of satisfaction or dissatisfaction and Locke (1969) describes dissatisfaction as displeasure and satisfaction as pleasurable.

For the purpose of this study and drawing on the above definitions, satisfaction was understood as the state by which an individual expresses positive and negative attitude to work experiences specifically with ICT. The study reported in this thesis drew on this definition of satisfaction in examining teachers' satisfaction with using ICT in the classroom.

2.6.2 Past research on teachers' satisfaction with ICT

Whilst there is an abundance of research on teachers' job satisfaction (Darmody & Smyth, 2014; Dinham & Scott, 1998a, 1998b, 2000; Evans, 2001; Skaalvik & Skaalvik, 2010; Wagh, 2016), past research on teachers' satisfaction with ICT is limited. Related literature includes: use of ICT for teacher training (Fry & Hin, 2006); and satisfaction with ICT professional development (Mouzakis, Roussakis & Tsagarissianos, 2010; Tasir, Abour, Halim & Harun, 2012). Cheok and Wong (2015) provide a synthesis of e-learning satisfaction studies.

My review of literature indicated a dearth of literature related to teachers' satisfaction with ICT. This section reviews the studies that were found. Teacher training provides

one opportunity to use and interact with technology. Technology-assisted learning, used for teacher feedback, is considered particularly useful for teachers of physical education, for increasing role satisfaction (Fry et al., 2006). Their study involved student teachers' peer coaching using interactive wireless communication devices as they conducted physical education lessons. The 'in ear' technology provided opportunity for purposeful use of technology whilst providing 'in the moment' verbal feedback and communication. Satisfaction was examined in conjunction with the role of the teacher, the influence of communication on satisfaction, and satisfaction with the device. Initially, teachers reported increased satisfaction, possibly due in part to the positive reinforcement aspect of the verbal feedback. Participants also reported a positive effect on their satisfaction when using the technology.

Whilst Fry et al. (2006) examined the direct 'hands on' experience of using technology for professional learning, other studies have involved teacher satisfaction associated with specifically-designed technology training courses. One such study, by Mouzakis et al. (2010), involved the European Pedagogical Information and Communication License with primary and secondary Greek teachers. The purpose of the study was to investigate teacher satisfaction with learning involving a blended design (online and face-to-face). The study indicated overall satisfaction with the course and that satisfaction was affected by the convenience of being able to complete the course in the teachers' own time and the content of the course involving good teaching practice and ICT use. Timely feedback, support and encouragement by the facilitator also contributed to teachers' sense of satisfaction with the training course.

Another study by Tasir et al. (2012), who involved teachers' satisfaction with ICT training programmes in Malaysia. Although not related to satisfaction with ICT per se, this study indicated a positive association between teachers' confidence towards using ICT and satisfaction towards ICT training programmes.

The studies outlined are limited by their lack of examination of teachers' use of ICT within the classroom setting for the purpose of student learning. Teachers' use of technology was a central component of my study together with their satisfaction with the use of ICT. Cheok et al. (2015) provides a synthesised study of teachers' satisfaction with technology to identify predictors of satisfaction. They identified three

potential causes of teachers' satisfaction with technology: user related (anxiety, attitude and self-efficacy), organisation related (training, technical and management support) and system related (perceived ease of use and usefulness, accuracy and interaction). They hypothesised that anxiety, attitude and self-efficacy, are significantly related to teachers' satisfaction. They further hypothesised a significant relationship between training, management, technical support, usefulness, ease of use, flexibility and interaction with teachers' satisfaction. Their final hypothesis was that the use of an e-learning system has a significant influence on teachers' satisfaction with technology. My study specifically examined teachers' satisfaction with working with technology, their levels of enjoyment and their desire to continue using ICT.

2.6.3 Instruments developed to measure satisfaction

To assess teacher satisfaction with ICT, it was necessary to identify a suitable instrument. Given the dearth of instruments suitable for assessing satisfaction, this section reviews job satisfaction instruments that could be modified for use.

Tsai, Huang, Wang, Chen, Pan, Wang … Chang (2016) recognised the need to include importance and performance (IPA) when measuring job satisfaction. In their research, they developed a criterion matrix to measure job satisfaction by including three conditions: a clearly-defined problem, the relationships of the problem, and the characteristics of the problem. A six-step complex procedure was developed for their research using this model. This method of measurement of job satisfaction was not selected for my study as it did not align with other aspects of this research.

Dinham and Scott (1996a, 1997, 1998b, 2000) developed a 75-item, seven-point Likert, self-report questionnaire to measure teacher satisfaction and dissatisfaction since commencing teaching. The extensive 75-items scale was used with a large group of teachers and school executives. Exploratory and confirmatory factor analyses resulted in an eight-factor satisfaction scale: self-growth, student achievement, school reputation, school leadership, school infrastructure, workload and impact of change, merit promotion and status of teachers. Whilst the scale developed by Dinham and Scott (2000) was somewhat useful for the study presented in this thesis, it was not selected.

The Brayfield-Rothe Index of Job Satisfaction developed by Brayfield and Rothe (1951) was used in a study of efficacy beliefs of special educators by Viel-Ruma, Houchins, Jolivette, and Benson (2010). The index is made up of 18 items about how participants feel about their jobs (e.g. *I feel fairly satisfied with my job).* Whilst the research conducted by Viel-Ruma et al. (2010) was related to efficacy beliefs of teachers, the items were somewhat dated. Therefore, the Brayfield-Rothe Index of Job Satisfaction was not selected for use in this study.

Aldridge and Fraser (2016) drew on the Job Description Index (Smith, Kendall & Hulin, 1969) and the Job Satisfaction Survey (Spector, 1997) to develop the Teacher Work Satisfaction Scale. The eight-item scale specifically assessed teachers' level of satisfaction and enjoyment using a five-point frequency scale. The Work Satisfaction Scale was modified for the purpose of the study presented in this thesis because it measured both satisfaction and enjoyment. Details related to this scale and its adaption for this study are provided in Chapter 3.

2.7 Chapter Summary

This study examines the relationship between teachers' perceived knowledge and skills confidence with using Information Communication Technology (ICT) and the outcomes of teachers' burnout, self-efficacy and satisfaction. Accordingly, this chapter reviewed literature related to technology use in the classroom, teacher confidence, teacher burnout, teacher self-efficacy and teacher satisfaction.

Section 2.2 reviewed literature related to technology use in the classroom by firstly considering definitions. Past research suggests that there are three aspects to the definition: the software and hardware, the student, and the teacher. This study defined technology use as teachers' use of technology resources including software and hardware (Bharati, 2014; Dawson, 2008; Dutton, 2012; Hennessy, Ruthven & Brindley, 2005; Masango, 2014; Peters, 2007) in order to provide innovative pedagogy that leads to relevant and transformational learning for students (Ertmer & Ottenbreit-Leftwich, 2013; Hughes, 2005). As users of technology in the classroom, both the teacher and student reformulate knowledge to creatively produce information with digital devices (Soujah, 2014).

Past research indicates two common themes that relate to teachers' confidence with using technology. The first theme involves the increase in the presence of technology stemming from the Common and Agreed National Goals for Schooling (AEC, 1989) and continued to the Digital Education Revolution policy (White, 2008). The presence of technology in the classroom is no longer a question for consideration. Although barriers (lack of teacher self-efficacy and technology knowledge and skills) exist (Hew et al., 2007), technology integration is considered fundamental in providing innovative learning (Ertmer, et al., 2013). The second theme involves teachers' professional development in technology, which was identified as a strategy to overcome barriers (Hew et al., 2007). The need for professional development to be non-threatening (Robertson et al., 2004) is critical for technology adoption (Lawless et al., 2007) and it ought to be intensive and invitational (Kanaya et al., 2005).

Section 2.3 provided a definition of teacher confidence and a review of past research related to teacher confidence. Following a review of literature on confidence generally, teacher confidence was defined for this study as the teacher's sense of conviction in his or her ability to successfully use technology in the classroom. This section also included a review of past research within the field of confidence specifically related to technology use. The literature on male and female confidence towards technology, was examined. Whilst there is some inconsistency, it suggests that males generally hold greater confidence than females (Jamieson-Proctor et al., 2008). This section concluded with a review of teacher experience and confidence with technology. The definition of teacher experience varied amongst studies, for example, years of experience (Alazam et al., 2012), whether teachers are pre-service and in-service teachers (Saltan et al., 2017), experience of usage (Broos, 2005) and age of teachers (Lau et al., 2008).

Section 2.4 provided past research on burnout and explored its definition. Maslach et al. (2008) re-defined burnout to include erosion of engagement, involvement and efficacy. The three dimensions of burnout syndrome, emotional exhaustion, depersonalisation and personal accomplishment (Maslach et al., 1996) were used to define burnout for this study. Past research on teacher burnout suggests an association with stress (Mearns et al., 2002) and self-efficacy (Brouwers et al., 2000). Teacher workload and job satisfaction have been found to be associated with emotional

exhaustion (Maslach et al., 2001). This current study specifically assessed all three dimensions of burnout for teachers using technology. Whilst burnout may pertain to the technology profession (Hetland et al., 2007), there is a lack research on teachers' use of technology and burnout.

Section 2.5 explored the definition of teacher self-efficacy, with Bandura's (1986, 1997) four-source theory of self-efficacy providing an important contribution in defining teacher self-efficacy. Self-efficacy for this study was defined as the belief an individual has in the ability to achieve a level of competency towards technology use. Research indicates that teacher-self efficacy relates to the teachers' beliefs about the capacity to provide meaningful learning (Lemon et al., 2016; Zee et al., 2016). Given that successful integration of technology requires enhanced self-efficacy (Wang et al., 2008), this study looked into the relationship between teachers' self-efficacy and their confidence in technology use. The literature reviewed suggests that there is limited research involving all three factors, namely, confidence, self-efficacy and technology use.

Section 2.6 reviewed the literature on teacher satisfaction with ICT. The definition of teacher satisfaction and past research related to this construct were examined. Satisfiers and dissatisfiers contribute to overall job satisfaction (Dinham et al., 1997) as do positive and negative evaluations about one's performance (Locke, 1969). Satisfaction is defined for the current study as the state by which an individual expresses the positive and negative attitude to work (with technology). There was limited literature that related directly to teachers' satisfaction with technology use.

In conclusion, this literature review highlights gaps related to technology use and the constructs of teachers' confidence, self-efficacy, satisfaction and burnout.

Chapter 3

RESEARCH METHODS

3.1 Introduction

Informed by my review of literature, this chapter describes the research methods used in my study to investigate teachers' confidence in their ICT pedagogical knowledge and teachers' confidence in their ICT pedagogical skills and how they impacted on their self-reports of burnout, efficacy and satisfaction. The chapter starts by outlining the research objectives introduced in Chapter 1 (Section 3.2). Details are then provided regarding: the sample (Section 3.3); the instruments (Section 3.4); pilot study and data collection (Section 3.5); and the data analysis (Section 3.6). Ethical considerations are described in section 3.7 and the chapter concludes with a summary (Section 3.8).

3.2 Research Objectives

The research objectives, introduced in Chapter 1, are reiterated here. The overarching aim of my research was to better understand the impact of confidence in technology use by teachers. Specifically, the research examined whether the level of teachers' confidence with using technology was related to their burnout, self-efficacy and satisfaction. To investigate this aim, three objectives were delineated.

Research Objective 1

To develop and provide evidence to support the reliability and validity of the three surveys that were used in the present study to assess:

a. The confidence of teachers as they use technology in terms of their ICT pedagogical knowledge;
b. The confidence of teachers as they use technology in terms of their ICT pedagogical skills;

c. The impact of confidence in technology in terms of: teachers' perceptions of burnout; self-efficacy to influence decision making; self-efficacy when using ICT; and satisfaction with working with ICT.

Research Objective 2

To investigate whether teachers' confidence, when using ICT with students, is related to the teachers':

a. Burnout;
b. Efficacy; and
c. Satisfaction.

Research Objective 3

To investigate whether confidence using ICT, burnout, efficacy and satisfaction differs for:

d. Male and female teachers;
e. Teachers of different ages; and
f. Teachers who use technology for different frequencies.

3.3 Sample

As a quantitative study, convenience sampling was adopted as the researcher anticipated selecting participants who would be willing and available to undertake the study (Creswell, 2002, p. 145). This section details the sample involved in the present study in terms of the: sample space (Section 3.3.1), target sample (Section 3.3.2), and actual sample (Section 3.3.3).

3.3.1 Sample Space

The researcher sought to survey a sample space of teachers who were engaged with technology use in the classroom. At the time of the study, the South Australian Government's curriculum for students in years 6 to 10 was transitioning to the Australian Curriculum, directed by ACARA (Australian Curriculum and Assessment Authority). A significant inclusion to the Australian Curriculum (Foundation to Year

10) was the Learning Continuum of Information Communication Technologies (ICT) Capability (ACARA, 2012). In addition, at a state level, students in Years 11 and 12 undertake the South Australian Certificate of Education (SACE), which requires them to show competencies in seven capabilities of which one is the Information and Communication Technology capability (Gibbons, 2006). Given that technology use is a compulsory aspect of both the state and Australian curriculums (reaching from Foundation through to Year 12), the sample space of teachers appeared strong.

In South Australia, there are three types of schools: government schools (Department of Education and Child Development), Independent schools and Catholic schools. The South Australian Department for Education and Child Development is responsible for providing free tuition, accessible and local education for the children of South Australia. Government schools in South Australia include preschools, primary and secondary schools (Reid, 2017). Educating nearly 20% of South Australian students, the Independent school sector is made up of schools from a variety of religious backgrounds and educational philosophies along with secular and special schools (AISSA, www.ais.sa.edu.au/). In the Catholic sector, there are both system schools (Catholic Education South Australia, [CESA]) and religious order owned and governed Catholic schools. The researcher was a long-term employee of CESA and therefore had a keen interest in this sector. There was an expectation that this research would contribute to understanding teachers' confidence in technology use by teachers within Catholic schools in line with the CESA School Improvement Framework (Continuous Improvement Framework for Catholic Schools, Implementation Version February, 2014). There were 32 schools that identified as Reception to Year 12, middle, or secondary Catholic schools in South Australia.

3.3.2 Target Sample

The target sample is defined as the number of teachers employed at those schools whose principal indicated they would administer the survey. Initially, the target sample was to include teachers working in Reception to Year 12, in middle and in secondary Catholic schools in South Australia. The researcher specifically sought responses from teachers in these school settings based on her initial observations of secondary teachers using technology. As described by Alexander, Barnett, Mann, Mackay, Selinger and

Whitby (2013), the Digital Education Revolution Policy aimed to transform teaching and learning. Further to this, the introduction of the one-to-one device for students in Years 9 to 12 (Australian Government's Digital Education Revolution Policy, 2008) was unfolding. At the time of the study, teachers were unable to escape from the presence of technology in teaching and learning practices in secondary education. This section describes the target sample in terms of the secondary education schools (Section 3.3.2.1) and teachers (Section 3.3.2.2).

3.3.2.1 Target Sample: Schools

Invitations to participate in the current study were sent to 32 Catholic schools that were located in South Australia. The researcher had strong connections with a number of the schools and anticipated that the study would be supported by their respective principals. To increase the generalizability of the results, the 32 schools that were selected were typical in terms of enrolment size, socio-economic status and geographical location (rural and metropolitan). Of the 32 schools, 11 participated in the study. Initially it was assumed that this would be sufficient but the response rate at the end of the first round of administration was inadequate (N=161).

Given the low response rate from the Catholic schools, the target sample was expanded and a second phase of data collection was conducted. (Section 3.5.3 provides a description of the administration of this second sample.) A further 10 Independent schools, based on the advice of a senior colleague connected to the Independent sector, were invited (by letter and email) to participate in the study. It was estimated that, if all 10 Independent schools responded positively, their inclusion would add a potential 865 teacher responses. The target sample space was calculated by adding the total number of teachers who were teaching at the schools invited to participate in the study. By extending the invitation to include 10 Independent Schools the sample space expanded from 32 to 42 schools and from 2280 to 3145 teachers (see Table 3.1 for the target sample space breakdown by teachers and schools).

Table 3. 1 Target Sample Space

Participants	**Target Sample Space**				
	Number			Percentage	
	Catholic	Independent	Total	Catholic	Independent
Teachers	2280	865	**3145**	72%	28%
Schools	32	10	**42**	76%	24%

3.3.2.2 Target Sample: Teachers

As discussed earlier, in the first instance, the schools were selected because the researcher had a strong connection with the Catholic sector. If all of the teachers who were teaching in the 32 Catholic schools had responded to the survey (Section 3.5.3 describes the administrative process), this would have provided a sample of 2280 responses (see Table 3.1). From the 32 Catholic schools, 11 schools responded to the invitation to participate. From the 11 Catholic schools, the target sample was considered ample (N = 670). The invitation to 10 Independent schools (N = 230) was extended to increase the number of potential participants and to expand the data. As a result of this invitation, the target sample size increased (N = 900) and represented 29% of the sample space (see Table 3.2 for the target sample of teachers' breakdown by school type).

Table 3. 2 Target Sample Teachers

Participants	**Target Sample Teachers**	
	School Type	Number of participants
Target Sample Teachers	Catholic	670
	Independent	230
	Total Teachers	**900**
Target Sample Teachers %	Catholic	74%
	Independent	26%
Target Sample as % of Potential Target Sample	Catholic	21%
	Independent	7%
	Combined	29%

3.3.3 Actual Sample

The distribution of schools in the actual sample is described in Section 3.3.3.1 and the distribution of teachers in the actual sample is described in Section 3.3.3.2.

3.3.3.1 Actual Sample Schools

Of the 42 schools that were approached, teachers in 14 were involved in survey: 11 Catholic schools and three Independent schools. The actual sample included a range of schools in terms of coeducational and single sex schools (*n*= six coeducational schools, six all-girls' schools and two all-boys' schools). The actual sample was made up of: 10% of the coeducational schools, 50% of the all-girls schools and 28% of the all-boys schools (at the time) in South Australia (The Australian Schools Directory, 2017). The schools also ranged in terms of the year levels for which they catered. Seven of the schools catered for Reception to Year 12, four schools catered for Years 8 to 12, one school catered for Years 6 to 9, one school catered for Years 6 to 12 and one school catered for Years 11 to 12.

The schools that agreed to be involved in administering the survey also came from different geographic regions within South Australia. Two of the 14 schools were located in regional areas, three were city schools and the remaining nine schools were located in metropolitan areas. Using the Australian Schools Directory (2017), it was calculated that the city schools in the actual sample account for 42% of the target sample. The nine metropolitan schools in the actual sample account for 23% of the target sample. The two regional schools make up 14% of the actual sample and were both Catholic schools. This is consistent with the 17% of regional Catholic secondary schools in South Australia (Catholic Education South Australia, Schools Directory, 2017). The Independent schools of the actual sample do not represent regional areas as there were no regional Independent schools approached to complete the survey. The three city schools included two Catholic schools and one Independent school. The nine metropolitan schools made up 64% of the actual sample.

Finally, the schools involved in administering the survey ranged in socio-economic backgrounds. To identify the socio-economic backgrounds of the schools, the Index of

Community Socio-Educational Advantage (ICSEA) was used. The ICSEA scale "was created by the Australian Curriculum, Assessment and Reporting Authority (ACARA) specifically to enable fair comparisons of National Assessment Program – Literacy and Numeracy (NAPLAN) test achievement by students in schools across Australia" (ACARA Fact Sheet, 2015, p. 2). The score is created according to the socio-economic status of the student population and is calculated using information gathered on parent occupation and education, the population of Indigenous students and the schools' geographical location. The ICSEA benchmark is 1000 with a standard deviation of 100. "The lower the ICSEA value, the lower the level of educational advantage of students who go to this school" (ACARA Fact Sheet, 2015, p. 1). The ICSEA scores for the different schools in the study reported in this thesis ranged from 944 (for School 8) to 1167 (for School 12) indicating a wide variation in school socio-educational standing. (A breakdown of structure, location, ICSEA and student population for each school can be found in APPENDIX A.)

3.3.3.2 Actual Sample: Teachers

Of the 900 teachers who received the invitation to participate in the study, 177 teachers positively responded. Of these responses, 163 were considered valid. As recommended by Alreck and Settle (1995), the remaining 14 responses were discarded due to missing data. Of the 163 responses 149 were from teachers in Catholic schools and 14 were from teachers in Independent schools, representing18% of the target sample.

Whilst 64% of the sample space schools agreed to their teachers participating in the study, only 29% of the sample space teachers completed the survey. That is, whilst the 14 schools provided a target sample of 900 teachers (see Section 3.5.3 for more information about the administration of the surveys), only 177 teachers responded to the survey. Following scrutiny of the data (after omitting surveys that were incomplete or unusable), 163 teachers' responses (18% of the target sample) made up the actual sample. The remainder of this section describes the actual sample teachers according to sex, age and years of teaching.

Of the 163 teachers who responded to the survey, 47 were males and 116 were females. (APPENDIX B provides a breakdown of the distribution of the teacher sample in terms

of sex, age and years of teaching). This distribution was consistent with the distribution of male and female teachers across all Catholic and Independent schools in SA in 2014 (ABS 2016), in which females made up the larger total percentage of the participants.

The survey required teachers to record their age under one of seven categories. These categories were adapted from the 10 age categories as described in the 2010 and 2013 Staff in Australian Schools reports (ACER, 2011, 2014). The distribution of teachers in each of the age groups is summarised in Table 3.3.

The percentage of respondents per age group is somewhat consistent with the population of secondary teachers in Australian schools as reported in the Staff in Australia's Schools (SiAS) 2013 report (McKenzie, Weldon, Rowley, Murphy & McMillan, 2014). This report indicated that 21% of all secondary teachers were aged between 26 and 35 years, 25% were aged between 35 and 44 years and 19% were aged between 55 and 64 years. Based on the 2013 SiAS report, the sample distribution by age for this research is considered representative.

Table 3. 3 Age Distribution of Teachers in Actual Sample

Age	Number of Teachers	% of the Sample
18 to 24 years	4 teachers	2% of the sample
25 to 34 years	43 teachers	26% of the sample
35 to 44 years	33 teachers	20% of the sample
45 to 54 years	44 teachers	27% of the sample
55 to 64 years	32 teachers	20% of the sample
65 to 74 years	7 teachers	4% of the sample
75 years or older	0 teachers	0% of the sample

For analysis purposes, the number of age groups for this research was reduced to three; less than 35 years old, 35 – 54 years old and greater than 54 years old. These age groups were in line with those used in the NSW Department of Education and Communities (2013) publication entitled "Permanent school teacher age profiles 2013". Therefore, the sample consists of: less than 35 years old (N = 47 teachers and 28% of the sample); 35 to 54 years old (N = 77 teachers and 47% of the sample); greater than 54 years old (N = 39 teachers and 24% of the sample).

As part of the introduction to the survey, teachers were also asked to record how many years they had been teaching by indicating one of seven categories: pre-service teacher; 0 to 3 years; 4 to 10 years; 11 to 20 years; 21 to 30 years; 31 to 40 years; more than 41 years. The percentage response for each category was diverse (1% response pre-service teachers through to 27% response 4 to 10 years of teaching). To provide data related to early-career teachers, mid-career teachers and late-career teachers (Hargreaves, 2005), four brackets were created from the original data: Pre-service to 3 years (n =12 Teachers) made up 7% of the sample; 4 to 10 years (n = 46 Teachers) made up 28% of the sample; 11 to 30 years (n = 68 Teachers) made up 42% of the sample; and 31 and more years (n = 37 Teachers) made up 23% of the sample.

In summary, as described above, the sample included 163 teachers from 11 Catholic schools and four Independent schools, including 47 male teachers and 116 female teachers ranging from early to late career. The next section describes the development of the surveys used to collect data for the present study.

3.4 Instruments

Given the dearth of surveys that were suited to the context in which the study took place (see Chapter 2), the collection of data for this study required the modification of four previously established surveys to assess: teacher confidence (described in Section 3.4.1); teacher burnout (described in Section 3.4.2); teacher efficacy (described in Section 3.4.3); and teacher satisfaction (described in Section 3.4.4).

This section describes the scales and how they were modified from the source instrument.

3.4.1 Assessing Teacher Confidence

The items in the teacher confidence survey were modified from the Technology Pedagogy Content Knowledge (TPACK) Confidence Survey, the development of which is reported by Albion, Jamieson-Proctor and Finger (2010) and Jamieson-Proctor, Albion, Finger, Cavanagh, Fitzgerald, Bond, and Grimbeek (2013). The TPACK framework was developed following an examination of two small-scale

studies; one completed by Koehler and Mishra, (2005) with 17 participants, and another by Koehler, Mishra and Yaha, (2007) with 24 participants. Building on the Pedagogical Content Knowledge (PCK) framework, described by Shulman (1986), Mishra and Koehler (2006) included technological knowledge (TK) to cover the ICT knowledge required by teachers (Albion, et al., 2010). TPACK was used in the *Teaching Teachers for the Future* project of 2010 to highlight the knowledge that Australian teachers needed to achieve the intent of the Digital Education Revolution (DER) (Jamieson-Proctor et al., 2013). Since its inception, evidence has been provided to support the validity of TPACK (see, for example, Abbitt, 2011; Albion, et al., 2010; Koehler, Shin & Mishra, 2012).

To examine the technological, pedagogical and content knowledge of pre-service teachers, Albion et al. (2010) developed the TPACK Confidence Survey (TCS) based on their previous work to measure confidence in the classroom (Jamieson-Proctor et.al, 2013). The TCS instrument is made up of two scales; Confidence to use ICT, and Usefulness of ICT (Jamieson-Proctor et.al, 2013, p.29). See APPENDIX C for a copy of the Original TPACK Confidence Survey and permission to use.

For the study reported in this thesis, the Confidence to use ICT scale of the TCS instrument was modified. The 24 original TCS items were reduced to 15 and the seven response categories were reduced to five (with the unable to judge category retained). Furthermore, TCS was re-structured so that it could be used to assess teachers' confidence in both their knowledge of ICT as well as their skills with ICT. To do this, first, the stems for each of the statements were modified. For example, the stem of one of the original statements "How confident are you that you have the knowledge, skills and abilities to support student use of ICT to…" was changed to "*Rate your confidence in your ICT Knowledge* when using it to…". Second, the syntax of each statement was modified to create a more accessible survey for teachers. For example, an original statement "Use ICT and teaching strategies that are responsive to students' diverse backgrounds?" was simplified to "*be responsive to students from diverse backgrounds*". Table 3.4 provides further examples of how the original statements of the TCS were modified for use in this study.

Each of these two surveys, Confidence in ICT Pedagogical Knowledge (CIP Knowledge Survey) and the Confidence in ICT Pedagogical Skills (CIP Skills Survey), had three corresponding scales: pedagogical scale; planning and communication scale; and digital citizenship scale. The first scale, pedagogical knowledge or pedagogical skills, was included to examine how teachers were experiencing technology with respect to their students' learning and engagement. These items included: respond to student's learning styles; teach specific subjects in creative ways; and design activities that engage students. The second scale, planning and communication knowledge scale or planning and communication skills scale, was included to capture how teachers felt about the use of technology with respect to their work, such as working with colleagues or administrative duties. Examples of these items included: manage student data; communicate with colleagues; and collaborate with colleagues for professional purposes. The final scale, digital citizenship knowledge scale or digital citizenship skills scale, assesses how teachers' ICT confidence was experienced when using it (for example) to promote students' rights and responsibilities; promote student awareness of digital citizenship; and promote safe use of digital information.

For the CIP Knowledge Survey, the scales were: pedagogical knowledge scale (with five items); planning and communication knowledge scale (with six items); and digital citizenship knowledge scale (with four items). For the CIP Skills Survey, these scales were: pedagogical skills scale (with five items); planning and communication skills scale (with six items); and planning and communication skills scale (with four items).

The items were responded to using the same five-point Likert-type scale used in the original instrument: No Confidence (with a value of one); Little Confidence (with a value of two); Moderate Confidence (with a value of three); A lot of Confidence (with a value of four); Full Confidence (with a value of five). Unable to Judge (with a value of zero) was also provided to capture non responders. See APPENDIX D for a full copy of the Confidence in ICT Pedagogical (CIP) Knowledge Survey and the Confidence in ICT (CIP) Pedagogical Skills Survey used for this research.

To assess teacher burnout, the Maslach Burnout Inventory (MBI) was modified to examine the emotion and energy of teachers. The intention of the MBI was to

understand how people, specifically in the helping professions, view their work (Maslach & Jackson, 1986, p. 3463). The MBI assesses three sub-scales related to burnout, emotional exhaustion, depersonalization and personal accomplishment burnout (Schaufeli, Leiter, & Maslach, 2009). See APPENDIX E for a copy of the Maslach Burnout Inventory and permission of use.

Table 3. 4 Stem and Items for Original TCS and for Modified CIP Knowledge and CIP Skills

Teacher Confidence Survey (TCS)		**CIP Knowledge Survey** Question 9. Pedagogical Knowledge	
Original Opening Stem	Original Item	Modified Opening Stem	Modified Item
How confident are you that you have the knowledge, skills and abilities to support student' use of ICT to…	Use ICT and teaching strategies that are responsive to students' diverse backgrounds?	Rate your confidence in your ICT *Knowledge* when using it to:	Respond to student's diverse backgrounds.
	Use ICT and teaching strategies that are responsive to students' learning styles?		Respond to student's learning styles.
	Use ICT and teaching strategies to personalise learning activities for students?		Personalise learning activities for students.
		CIP Skills Survey Question 12. Pedagogical Skills	
	Use ICT and teaching strategies that are responsive to students' diverse backgrounds?	Rate your confidence in your ICT *Skills* when using it to:	Respond to student's diverse backgrounds.
	Use ICT and teaching strategies that are responsive to students' learning styles?		Respond to student's learning styles.
	Use ICT and teaching strategies to personalise learning activities for students?		Personalise learning activities for students.

3.4.2 Assessing Teacher Burnout

The MBI was modified, for the purpose of this study, to create a burnout scale. Of the 22 statements in the MBI, 10 were retained for this study. The items that were chosen all related to burnout and feelings towards work, such as "I feel emotionally drained from my work" and "I feel burned out from my work". Some of the statements were modified to make them more relevant for teachers in schools. For example, "I feel emotionally drained from my work" was changed to "I feel emotionally drained at school", and "I don't really care what happens to some recipients" was changed to "I don't really care what happens to some students". Table 3.5 provides examples of how the original statements have been modified for use in this study.

For the original MBI, items were responded to using a six-point frequency scale ranging from Never to Every Day. This was modified to be consistent with the five-point scale used for the other parts of this survey: Not at all, Very little, Somewhat, Quite a lot, and A great deal. See APPENDIX D for a full copy of the Teacher Burnout Scale.

Table 3. 5 Original MBI Items and Teacher Burnout Items

Original MBI Items	Modified Item
I feel emotionally drained from my work.	I feel emotionally drained at school.
I feel fatigued when I get up in the morning and have to face another day on the job.	I feel fatigued when I get up in the morning and have to face another day at school.
I don't really care what happens to some recipients.	I don't really care what happens with some students.

3.4.3 Teachers' Efficacy

To assess teachers' self-efficacy with using digital devices, the original Bandura Teacher Self-Efficacy Scale (Bandura, 1997) was modified for use in the present study. The Bandura Teacher Self-Efficacy Scale has 30 items in seven scales of: Efficacy to Influence Decision Making, Efficacy to Influence School Resources, Instructional Self-Efficacy, Disciplinary Self-Efficacy, Efficacy to Enlist Parental Involvement, Efficacy to Enlist Community Involvement and Efficacy to Create a Positive School Climate (Bandura, 2006 p. 328). For the purpose of this study, two of the seven scales were deemed relevant and were selected for use: Influence Decision Making and Instructional Self-Efficacy. The two sub-scales were modified to suit the purpose and content of this research. Modifications are described below and in Table 3.6.

In the first instance, it was necessary to change the nine-point response scale which involved five descriptors: nothing; very little; some influence; quite a bit; a great deal to a five-point scale of; not at all, very little, somewhat, quite a bit and a great deal. This nine-point scale was reduced to a five-point response format to provide consistency with the other scales. See Table 3.6 for a comparison of Bandura's teacher self-efficacy scale and those items used for this study. To ensure that the items were relevant to the context of the study, the wording was changed to include the term Information Communication Technology (ICT). This wording was added as a stem to make the purpose clear to the participant. Further, to make the response format meaningful to the items, the original items, which were written as questions, were changed to statements. For example, an original stem item "How much can you influence the decisions that are made in the school?" became "I can influence decisions that are made about ICT."

Two of Bandura's original scales were combined (Influence Decision Making scale and the Influence School Resources) because one of the scales was made up of only one item. The combined scale was renamed Self-efficacy to influence decision making scale and inlcuded three items. This combined scale (Influence decision making and influence school resourecs) included nine questions of which seven were selected for use in this study. The two items omitted were: "How much can you do to influence the class sizes in your school?"; "How much can you do to overcome the influence of adverse community conditions on student learning?" These two items were considered less likely to be linked to ICT expereinces and, therefore, not related to the research. Table 3.6 compares items in the original (Bandura, 1997) Teacher Self-Efficacy Scale with items used for this study. (See APPENDIX F for a full copy of Bandura's Self-Efficacy scales and permission of use.)

Table 3. 6 Scale Name and Sample Items for Bandura's Teacher Efficacy Scale This Study's Teacher Efficacy Scales

Bandura's Teacher Self-Efficacy Scales		**Teacher Efficacy Scales**	
Original Scale	Original Item example	Modified Scale	Modified Item
Efficacy to Influence Decision Making	How much can you influence the decisions that are made in the school?	Self-efficacy to influence decision making scale.	I can influence decisions that are made about ICT.
Efficacy to Influence School Resources	How much can you do to get the instructional materials and equipment you need?		I can express my views on ICT matters.
			I have access to ICT resources.
Instructional Self-Efficacy	How much can you do to get through to the most difficult students?	Self-efficacy when using ICT scale. When using ICT, I can…	Get through to the most difficult students.
	How much can you for to promote learning when there is a lack of support from home?		Promote learning with ICT when there is a lack of support from the home.
Disciplinary Self-Efficacy	How much can you for to get children to follow classroom rules?		
Efficacy to Enlist Parental Involvement	How much can you do to get parents to become involved in school activities?		
Efficacy to Enlist Community Involvement	How much can you do to get community groups involved in working with schools?		
Efficacy to Create a Positive School Climate	How much can you do to make the school a safe place?		

Original Likert Scale: 1 – 9 (Nothing; Very little; Some influence; Quite a bit; A great deal).
Modified Likert Scale: Not at all; Very little; Somewhat; Quite a bit; A great deal.

3.4.4 Assessing Satisfaction with Working with ICT

To assess teachers' satisfaction with working with ICT (technology), a scale was modified from Aldridge and Fraser's (2016) teacher job satisfaction scale. (See APPENDIX G for permission to use the teacher job satisfaction scale.) This scale drew on the Job Descriptive Index (Smith, Kendall & Hulin, 1969) and the Job Satisfaction Survey (Spector, 1997) to assess satisfaction and enjoyment in teachers' work. The eight items of the teacher job satisfaction scale were modified to create a five-item scale that assessed teacher satisfaction with working with ICT. The modifications included removing two items that were not relevant to the measurement of satisfaction with ICT and adding information to make clear that:

- Each statement was related to ICT (Information Communication Technology);
- The original statement "I enjoy working at this school" was modified to include two separate statements. (*I enjoy working with ICT* and *I enjoy teaching with ICT*); and
- Finally, the five-point response format used with the self-efficacy scale was used to maintain consistency.

Table 3.7 provides scale examples of the original and modified satisfaction items. See APPENDIX D for a full copy of the Satisfaction with working with ICT scale.

Table 3. 7 Original and Modified Items for the Teacher Work satisfaction Scale

Original Item example	Modified Item
I enjoy working at this school.	I enjoy working with ICT
Working at this school is personally satisfying.	Working with ICT is personally satisfying.
I enjoy the challenges at this school.	I enjoy the challenge of working with ICT.

Modified Likert Scale: Nota at all; Very little; Somewhat; Quite a bit; A great deal.

3.5 Pilot Study and Data Collection for Main Study

Once the surveys had been constructed, the next step was to ensure the face validity of the individual items. This stage involved two steps: cognitive pre-testing (discussed in

section 3.5.1); and a pilot study (discussed in section 3.5.2). Once satisfied with the face validity, data were collected from the main sample (described in section 3.5.3).

3.5.1 Cognitive Pre-testing of the CIP Knowledge, CIP Skills and BES Surveys

Cognitive pre-testing allows potential respondents the opportunity to review each question in the proposed survey (Fink, 2003). The purpose of cognitive pre-testing is to determine the suitability of the survey and individual items. The cognitive pre-testing involved the use of peer reviewers, selected on the basis that they were experienced in their field. For the purpose of this cognitive pre-test, 10 peer reviewers from the Catholic education sector were invited to participate. These peer reviewers included seven teachers, one middle manager and two senior leaders from the secondary education context.

Feedback for the cognitive pre-test involved interviews with each of the reviewers. During the interviews, reviewers were asked to complete the survey and then evaluate the clarity of each item, identify potential changes and evaluate the response formats (Fink, 2003). Based on these interviews, several changes were made.

First, the length of the items was reduced by using stems to precede the items. For example, “Using ICT, how much can you do to motivate students who show low interest in schoolwork?” was changed to “When using ICT, I can … (stem) motivate students (item).”

Second, although the CIP Knowledge survey and the CIP Skills survey were drafted with a four-point scale that included both a number value and description, the number values were not helpful and wording was queried. Therefore, to provide a greater range of response possibilities, these were changed to: No confidence; Little confidence; Moderate confidence; A lot of confidence; Full confidence; Unable to judge.

Third, for the CIP Knowledge Survey and the CIP Skills Survey, the phrasing of the stems and items was changed. For example, “How confident are you that you have the knowledge to … (stem) use ICT with teaching strategies that are responsive to

student's diverse backgrounds? (item)" was changed to "Rate your confidence in your ICT Knowledge when using it to (stem) respond to diverse backgrounds (item).".

Fourth, to ensure that participants were clear about how to respond, a brief statement to introduce each scale was added. The Burnout scale was introduced with the statement "Please read each statement carefully and choose the response that best expresses how you feel about being a teacher." The Self-Efficacy and Satisfaction scales were introduced with the statement "For each statement below, rate the effect that you have on this aspect of your work.".

3.5.2 Pilot Study

Informed by the cognitive pre-testing of the instruments (reported in the previous section), an online version of the surveys was developed using SurveyMonkey Audience. A pilot study, involving 23 teachers (invited from the researcher's school) was carried out during a designated staff meeting. The purpose of the pilot study was to evaluate the instrument from the perspective of potential participants, and to ascertain whether they were able to complete the survey and understand the questions (Creswell, 2002). The pilot study also allowed the researcher to observe the accessibility of SurveyMonkey Audience and the length of time the survey took to complete.

The SurveyMonkey Audience hyperlink was forwarded to participants via email. Upon completion of the survey, the pilot study participants provided comments for each scale on a hard copy of the survey, along with verbal feedback directly to the researcher. The researcher gathered and noted the feedback, which was later discussed with one of the 10 peer reviewers (Section 3.5.1) to determine what changes, if any, needed to be made.

During the designated pilot study staff meeting, participants provided both verbal and written comments about the survey. Written comments included responding to questions with respect to the different scales, such as: Did the response format follow a logical path from the stems and items? Did the response options provide enough choice for the participant? The participants were also asked to comment on the

organisation of the instrument by responding to questions such as: Are the instructions easy to follow? Are the terms 'confidence', 'burnout', 'self-efficacy' and 'satisfaction' understood for the context in which they have been written? Were the items easy to understand? If not, what suggestions would you make for improvement? A copy of the feedback sheet provided to participants can be found in **APPENDIX H**

The pilot study also sought feedback on the repetitive nature of the two confidence in ICT pedagogical surveys, with the difference being in the use of the word *knowledge* or the word *skills*. For example, the stem "Rate your confidence in your ICT *Knowledge* when using it to…" was very similar to the stem "Rate your confidence in your ICT *Skills* when using it to…" followed by the same item "Respond to student's learning styles". Participants were asked to comment on this use of repetition.

The 23 teachers provided both general and specific feedback on the structure and content of the surveys. The results of the pilot study are reported here in terms of: the length and accessibility of the survey; instructions and terms used in the survey; and problems identified in the survey items.

Firstly, the length and accessibility of the survey were both reported as manageable. Participants in the pilot study reported a completion time of between 15 and 20 minutes. The layout of the instrument, along with its structure, were considered accessible and no procedural flaws were reported. The response formats for both surveys were reported as being understood by all participants.

According to the teachers involved in the pilot study, the instructions were clear and easy to comprehend. The terms, 'confidence', 'burnout', 'self-efficacy' and 'satisfaction' were reported as being understood. The flow from the stems to the items was considered clear and the sequence of questions was reported as easy to follow.

There were two aspects of the survey that teachers in the pilot study reported as moderately problematic. First, it was felt that the items of the CIP Knowledge survey and the CIP Skills survey were repetitive. Three of the 23 teachers expressed confusion as to why the knowledge confidence and skills confidence scales were repeated. This

was not the experience of other teachers in the pilot study. Second, one staff member commented that the Burnout scale did not appear to relate to ICT.

Following the pilot study, the researcher re-examined the instrument and discussed the feedback with a peer reviewer. It was agreed that, whilst the comments regarding the repetitive nature of the confidence scale were worth noting, the scales needed to remain as described for the purpose of my study. The Burnout scale and ICT issue raised by one staff member was considered, however this scale was deliberate in its wording as it was related to teaching in general and not specific to ICT. As a result of the pilot study, no further changes were made and the instrument was prepared for wider distribution, as discussed in the following section.

3.5.3 Data Collection for Main Sample

The administration and data-collection process was designed to ensure standard and uniform procedures for all administrators (Creswell, 2002). The surveys were administered, following considerations of any possible ethical issues (outlined in Section 3.7). For each participating school (see Section 3.3.2.2), this involved seeking a supervisor who would oversee the administration of the survey. The role of the supervisor for each school appointed by the principal was to be the point of contact between the researcher and the teachers taking part in the survey. The supervisor was asked to do the following:

- Make a formal request of teachers to complete the survey.
- Forward the SurveyMonkey hyperlink for the survey to all teaching staff via email.
- Select a common time for the survey to be completed.

All supervisors were given the same script, which outlined the purpose of the survey, to copy and paste into the email that they sent to their staff. (A copy of this email can be found in APPENDIX I Supervisors were asked to email the researcher once the teaching staff members had completed the survey. On receipt of the supervisor's email, stating the completion of the survey, a thank you letter and email was forwarded to each school principal and supervisor.

An administration package was provided to each supervisor as both a hard copy and an electronic copy. The purpose of the package was to ensure that all supervisors were communicating the information related to the survey uniformly. The administration package included:

- A set of instructions for administration of the survey (a copy of which can be found in APPENDIX J);
- A copy of the survey (See APPENDIX D for a copy);
- A Participant Information Sheet (including a consent form). A copy can be found in APPENDIX K;
- A copy of the email to be sent to teachers in the school (See APPENDIX L for a copy); and
- A copy of the researcher's Ethics Approval from Curtin University (See APPENDIX M for a copy).

Throughout the administration process, the researcher made regular telephone and email contact with the supervisors as they distributed their surveys. No issues were reported, other than getting staff to complete the surveys. Supervisors had been asked to provide a common time, where possible, to administer the surveys. One school responded to this request by allocating time during a staff meeting to complete the online survey. As the survey was optional, some staff did not remain for that part of the staff meeting. Supervisors were encouraged to send a reminder email three times before it was agreed that any more could be 'disturbing the site' (Creswell, 2002, p. 23). The surveys remained open for a two-month period. The response rate of the surveys is reported in Section 3.3.3.2.

3.6 Data Analysis

The data collected from the surveys from 163 teachers provided an overview of teachers' self-reports of their confidence with using technology in the classroom, as well as their self-efficacy, satisfaction and burnout. This section describes the methods of statistical analyses undertaken to address each of the research objectives.

3.6.1 Validity and Reliability of Surveys (Research Objective One)

The first objective of this research was to develop and provide evidence to support the reliability and validity of the three surveys used in the present study to assess:

a. Confidence in ICT Pedagogical Knowledge (CIP Knowledge Survey);
b. Confidence in ICT Pedagogical Skills (CIP Skills Survey);
c. Teachers' burnout; self-efficacy to influence decisions, self-efficacy when using ICT and satisfaction with working with ICT (BES Survey).

As previously described, a pilot study was conducted to ascertain the accessibility of the instrument. Evidence to support the validity and reliability of the surveys involved examining the factor loadings and internal consistency reliability.

To assess the factorability of the data, Bartlett's test of sphericity indicated that $\chi^2 = 1754.04$ and that this value was statistically significant ($p < .001$). The Kaiser-Meyer-Olkin (KMO) was used to measure the appropriateness of the data. "Bartlett's test of sphericity should be statistically significant $p < .05$ and the Kaiser-Meyer-Olkin value should be .6 or above" (Pallant, 2013, p. 190). Principal axis factoring with oblique rotation was carried out to extract salient factors. According to Stevens (1992), the criteria for retaining an item are that it should have a factor loading of more than .40 on its *priori* scale and less than .40 on any other scale. This criterion was adopted for this research and is reported in Chapter 4. The importance of each factor was examined by calculating eigenvalues, with only those factors with eigenvalues greater than 1 retained as recommended by Kaiser (1960).

Cronbach's alpha coefficient (Cronbach, 1951) was used to provide a measure of internal consistency reliability for the different scales. Both the individual and the school mean were used as units of analysis. Cronbach's coefficient alpha provides the average correlation between all items in the scale, ranging from 0 to 1 and with higher values showing greater reliability (Pallant, 2013, p. 6). As recommended by Nunnally (1978) a cut-off value above .7 constituted an accepted scale.

3.6.2 Teachers' Confidence Levels Relationship to burnout, self-efficacy and satisfaction (Research Objective Two)

The second objective was to investigate whether teachers' confidence levels, when using technology, were related to the teacher outcomes (dependent variables) of: teachers' burnout, teachers' efficacy and teachers' satisfaction.

Simple correlation and multiple regression analyses were used to determine the relationship between teachers' confidence (both pedagogical knowledge and pedagogical skills) and burnout, self-efficacy and satisfaction. The Pearson *r* correlation coefficient is a measure of strength of the association between two variables and ranges from -1 to +1 with a value of 0 indicating no association. According to Cohen (1988), the magnitude of a correlation can be considered Small (.1 to .3 or -0.1 to -0.3), Medium (.3 to .5 or -0.3 to -0.5) or Large (.5 to 1.0 or -0.5 to -1.0) (Pallant, 2013). The Pearson correlation coefficient was computed using the following formula:

$$r = \frac{1}{n-1} \sum \frac{(x_i - \overline{X})(y_i - \overline{Y})}{s_x s_y}$$

Multiple regression is used to examine the combined relationship of multiple independent variables with a dependent variable (Creswell 2002). To examine the relationship between the dependent variables of self-efficacy, satisfaction and burnout and the independent variables of pedagogical knowledge, planning and communication knowledge, digital citizenship knowledge, pedagogical skills, planning and communication skills and digital citizenship skills, multiple correlations (R) were completed. The standardised regression coefficients were examined to determine which learning environment scales were independent predictors of the teacher outcomes.

3.6.3 Determinants of Teacher Confidence, Burnout, Self-efficacy and Satisfaction (Research Objective Three)

The third objective was to investigate whether confidence levels, burnout, self-efficacy and satisfaction differs for teachers of different sexes, ages or frequencies of technology use.

To examine whether differences were statistically significant, a one-way multivariate analysis of variance (MANOVA) was used. As a first step, preliminary assumptions were checked for violations of normality, linearity and homogeneity of variance-covariance matrices. Once these conditions were satisfied, MANOVA was performed to investigate differences. Wilks' lambda was checked to ensure that there was a statistically significant difference between the groups for the whole set of scales, prior to interpreting the one-way ANOVA for between-group differences for each individual scale. For those variables with more than two options (e.g. age group and frequency of technology use), Tukey's HSD post hoc procedure was used to identify for which pairs (e.g. ages) there was a statistically significant difference

The effect sizes were calculated to quantify the size of the differences between different groups. Effect size were used to provide information and add weight to the discussion of differences, rather than rely on statistical significance alone. For the purpose of this study, Cohens d was used to compare the means of two groups using the following formula:

$$d = \frac{M_{group1} - M_{group2}}{SD_{pooled}}$$

The differences are reported in standard deviations and interpreted using guidelines established by Cohen (1988) for group comparisons: small (0.2), medium (0.5) and large (0.8).

3.7 Ethical Considerations

Ethical considerations are complex by nature and demanding that the researcher pay close attention from the origin of the study through to completion and dissemination

(Creswell, 2002). Appropriate processes and procedures were applied to this study to alleviate any ethical concerns. Following Ethics Approval from Curtin University (see APPENDIX M for a copy of the approval letter), the process of seeking participants for the study was undertaken with careful consideration.

The process began by gaining appropriate permission from Catholic Educations South Australia (CESA) to invite schools to participate in the study. A letter was written to the Director of Catholic Education seeking permission to contact the Principals of the 32 Catholic schools in the target sample. The Director was provided with a description of the study and its purpose, along with a copy of the survey instrument. The Director was assured that full respect with minimal disruption would be accorded to the schools who participated in the study (Creswell, 2002). See APPENDIX N for a copy of the approval letter.

The following sections outline the steps taken to ensure informed consent (Section 3.7.1) and participant anonymity (Section 3.7.2).

3.7.1 Informed Consent

Following the Director's approval for the study, a letter was sent to 32 Principals of Catholic schools seeking permission to conduct the study with their teaching staff. The principals' letters included a full description of the study, a copy of the survey, approval letter from the Director of Catholic Education South Australia and ethics approval documentation from Curtin University.

Principals were also provided with a copy of the Information Sheet for Principals and Teachers. (See Appendix J for a full copy of this document.) This document also included a written consent form. As discussed in Section 3.3.2.1, following a lower than expected response rate from the Catholic schools, 10 Independent schools were invited into the study. The process for seeking permission from the Independent schools was to communicate in the first instance directly with the school Principal. Unlike the CESA schools, there was no outside authority who needed to be considered. A formal letter of request was sent which included a description of the study and its

purpose, a copy of the researcher's ethics approval, a copy of the survey instrument and the Information Sheet for Principals and Teachers.

The Information Sheet for Principals and Teachers provided important material for participants. The project title and principal researcher were identified. The purpose of the research was stated as the intention to 'examine whether the level of teachers' confidence with digital devices is related to burnout, efficacy and satisfaction'. The approach to the research was described and participants were informed that responding to the survey would take about 15 – 20 minutes. Surveys would be distributed to consenting teachers and participants were free to withdraw if the need arose and without prejudice.

The involvement and requirements of the participants were described in this document and teachers were reminded that their permission would be sought: there were no benefits or risks associated with participation; and participants were free to withdraw if the need arose. Other information included on this sheet was related to the anonymity, storage and future use of data, results, questions and complaints. The research approval code from Curtin university was also provided.

The second page of the Information Sheet for Principals and Teachers was titled Consent Form. Participants were asked to acknowledge that:

- They were informed and understood the purpose of the study.
- They had been given opportunity to ask questions.
- They were free to withdraw at any time without prejudice.
- Any potentially identifiable information would not be published.
- They agreed to participate in the study.

Willing participants completed the written consent form to confirm their willingness to take part prior to completing the survey.

3.7.2 Anonymity

All schools and teachers were assured of anonymity and that the process would cause minimal disruption to staff. To ensure anonymity, access to the raw data was made available only to the researcher and the Curtin University supervisor. Although participants identified their school (for analysis), all identifying marks (for both the participant and school) were replaced with numerical codes for the purpose of data analysis. All copies of the raw data were stored securely at Curtin University and will remain there for a period of seven years.

Schools were assured that all reference to individual schools, in the thesis and research publications, would be made only by their code and no identifying information would be published. However, individual principals were provided with a school report, if requested, showing an aggregated score for teachers' responses.

3.8 Summary of Chapter

This chapter has outlined the research methods used in this study to collect and analyse the data in relation to the objectives as outlined in Chapter 1. This section summarises the methods used.

The sample involved 163 teachers from 14 schools, 11 of which were from the Catholic sector and three were from the Independent sector. Of the 163 teachers, 47 were male and 116 were female. Three surveys were developed to collect data for the purposes of the research. To assess teachers' confidence with using ICT in their teaching, two surveys were developed: one to ascertain teachers' confidence in terms of their pedagogical knowledge associated with using ICT (named the CIP Knowledge Survey) and one to assess their confidence in their pedagogical skills associated with using ICT in the classroom (CIP Skills Survey). The development of these surveys drew on the previously developed TPACK Confidence Survey developed by Albion, Jamieson-Proctor and Finger (2010). The two confidence surveys (CIP Knowledge survey and CIP Skills Survey) each had three scales to assess the teachers' pedagogical knowledge or skills, planning and communication knowledge or skills and digital

citizenship knowledge or skills. Each survey had a total of 15 items that were responded to using a five-point Likert scale.

The third survey involved the development of scales to assess teachers' burnout, efficacy and satisfaction (known as the Burnout, Efficacy and Satisfaction Survey, BESS) The development of the scales for the BESS drew on: the Maslach Burnout Inventory (MBI; Maslach & Jackson, 1986); two scales from the Teacher Self-Efficacy scale (Bandura, 1997); and the Teacher Work Satisfaction scale (Aldridge & Fraser 2016).

The Teacher Burnout scale was developed based on the Maslach Burnout Inventory (MBI) which assesses emotional exhaustion, depersonalization and personal accomplishment. The MBI was modified for this study to include 10 of the original 22 statements. The items were responded to using a 5-point Likert scale consistent with other scales in the study: Not at all; Very Little; Somewhat; Quite a lot; A great deal.

Two of the scales (Influence Decision Making scale and the Influence School Resources scale) were combined from the original Bandura Teacher Self-Efficacy Scale (Bandura, 1997). Bandura's original survey involved 30 items in seven scales. Of the seven scales, two were modified for use in the study (Influence Decision Making and Instructional Self-efficacy). These two scales each had five items that were responded to using a five-point Likert scale (ranging from Not at all through to A great deal).

Finally, the Job Descriptive Index (Smith, Kendall & Hulin, 1969) and the Job Satisfaction survey (Spector, 1997), that were later modified by Aldridge and Fraser (2016) were used to assess teacher satisfaction with working with ICT. This scale was adapted for this study to include six items (as opposed to the original eight items used by Aldridge and Fraser, 2016). The items were responded to using the same five-point Likert scale used for the teacher efficacy scales (ranging from Not at all through to A great deal).

Administration of this survey also included gathering teacher demographic data including: name of school, age and sex, teaching qualifications and current position in

the school. Further, the participants were asked to indicate their years of teaching and how often they use ICT each week. The demographic questions were adapted from the Staff in Australian Schools Survey (McKenzie et al., 2014).

To ensure face validity of the instruments both cognitive pre-testing and a pilot study were conducted. The cognitive pre-testing was conducted by 10 peer reviewers who provided feedback on the clarity of the questions, identified potential changes and evaluated the response formats. The pilot study was conducted to evaluate the instrument from the perspective of participants. Pilot study participants provided feedback on: the length and accessibility of the survey; instructions and terms used in the survey; and problems identified in the survey. The process of administration and data collection at each school included a nominated supervisor who would promote and oversee the distribution of the survey to their staff. To help them to undertake their role, supervisors were provided with detailed documentation including instructions and a participant information sheet.

The methods of data analyses were outlined in Section 3.7 of this chapter under the three research objectives. The first objective of my study was to provide evidence to support the reliability and validity of the three surveys to assess teacher confidence, burnout, efficacy and satisfaction when using ICT. To provide evidence to support the validity of the instruments, data analysis was carried out to examine the factor loadings and internal consistency reliability of each survey. Bartlett's Test of sphericity was used to assess the factorability and the Kaiser-Meyer-Olkin (KMO) was used to measure the data's appropriateness. Stevens' (1992) criteria was adopted and as such factor loadings above .40 on the *a priori* scale and less than .40 on any other scale were retained. Eigenvalues were calculated, with those scales with eigenvalues greater than 1 being retained (Kaiser, 1960).

Cronbach's alpha coefficient was used as an estimate of the internal consistency reliability (Cronbach, 1951), providing the average correlation between all items in the scale. The unit of analysis was both the individual and the school mean for the scales in each of the surveys. A cut off of .7 (as recommended by Nunnally, 1978) was used to determine whether the internal consistency of a scale was satisfactory.

The second objective of my study was to investigate links between teachers' confidence burnout, self-efficacy and satisfaction. To determine the relationship between teachers' confidence (knowledge and skills) with burnout, self-efficacy and satisfaction, simple correlation and multiple regression analyses were used. Pearson two-tailed correlation coefficient, to measure the strength of associations, was calculated. A multiple regressions analysis was used to provide a more parsimonious examination of the relationship between burnout, self-efficacy and satisfaction with the CIP Knowledge Survey and the CIP Skills Survey. Standardised regression coefficients were examined to interpret which confidence scales made the largest independent contribution to variation in BESS scales.

The third objective of this study was to investigate whether confidence levels, burnout, efficacy and satisfaction differed for teachers of different sexes, ages and frequency of technology use. A one-way multivariate analysis of variance (MANOVA) was used to examine whether differences were statistically significant. Wilks' lambda provided evidence of the statistically significant multivariate difference between the groups. The one-way ANOVA for between-group differences was conducted for each individual scale. Tukey's Honestly Significant Different test (HSD) post-hoc comparison provided evidence of the statistically-significant pairwise differences between groups. Cohen's (1988) guidelines for group comparisons was used to interpret the magnitudes of differences: small (0.2), medium (0.5) and large (0.8).

Ethical considerations throughout the study ensured that risks to participants were minimised at all stages. Ethical considerations included gaining appropriate permission from governing bodies and principals. To ensure informed consent, participants were provided with written information regarding the purposes of the study as well as their rights as participants. Participants provided consent and were informed of their right to withdraw from the study at any time. Anonymity was ensured by assigning numerical codes to schools and participants for the data analysis.

The next chapter reports the data analyses and finding

Chapter 4

DATA ANALYSES AND FINDINGS

4.1 Introduction

As described in Chapter 3, three surveys were developed for the purpose of this study to assess: the confidence of teachers in terms of their ICT pedagogical knowledge (CIP Knowledge Survey); the confidence of teachers in terms of their ICT pedagogical skills (CIP Skills Survey); and four teacher outcomes (known as BESS): burnout; self-efficacy to influence decision making; self-efficacy when using ICT; and satisfaction with working with ICT. Using the newly-developed surveys, data was collected from 163 teachers in 11 Catholic and four Independent schools located in rural and metropolitan South Australia.

The data were analysed in various ways to address each of the research objectives. As a first step, evidence was provided to support the reliability and validity of the three surveys to provide confidence in the results for the subsequent objectives. The main purpose of my study was to investigate the relationship between teachers' confidence with using information technology in their teaching and self-reports of burnout, efficacy and satisfaction with working with ICT. In addition to examining the relationships between these variables, the study also investigated whether teachers' confidence, burnout, efficacy and satisfaction differed for: male and female teachers; teachers of different ages; and teachers who used technology for different amounts of time (frequency of use).

This chapter presents the results of the data analyses used to address each objective of my study.

In section 4.2, the results relating to the first research objectives, pertaining to the validity and reliability of the three surveys (Section 4.2.1) are reported: the Confidence in ICT Pedagogical Knowledge Survey (CIP Knowledge Survey) is reported in Section 4.2.1.1; the Confidence in ICT Pedagogical Skills Survey (CIP Skills Survey) is reported in 4.2.1.2; and the Burnout, Efficacy and Satisfaction Survey (BESS) is

reported in Section 4.2.2. The relationships between teachers' confidence, and teachers' burnout, self-efficacy and satisfaction with working with ICT (BESS) are reported in (Section 4.3), followed by the results related to differences in confidence for teachers of different sex, ages and who used technology for different amounts of time (Section 4.4). The chapter concludes with a summary (Section 4.5).

4.2 Reliability and Validity of the Surveys

The first objective was to provide evidence to support the reliability and validity of the three surveys that were developed for use in the present study to assess:

a. The confidence of teachers as they use technology in terms of their pedagogical knowledge of ICT (CIP Knowledge; reported in Section 4.2.1.1)
b. The confidence of teachers as they use technology in terms of their pedagogical skills in using ICT (CIP Skills; reported in Section 4.2.1.2);
c. Teachers' burnout; self-efficacy to influence decision making; self-efficacy when using ICT; and teacher satisfaction with working with ICT (BESS; reported in Section 4.2.2).

As described in Chapter 3, the research included three surveys: one to assess teachers' confidence in their pedagogical knowledge of technology (CIP Knowledge Survey) and its use; one to assess teachers' confidence in their pedagogical skills (CIP Skills Survey) with respect to using technology; and one to assess technology use in terms of: teachers' perceptions of their sense of burnout; self-efficacy to influence decision making; self-efficacy when using ICT; and satisfaction with working with ICT (BESS). The validity of each of these is reported below.

4.2.1 Validity and Reliability of the CIP Knowledge and CIP Skills Surveys

As explained in Chapter 3, items in the CIP Surveys are related to confidence with the use of ICT in terms of their pedagogical, planning and communication, digital citizenship knowledge or skills. As a first step, the multivariate normality and sampling adequacy of the data (N = 163) were examined. Bartlett's test of sphericity (Pallant, 2013) indicated that $\chi^2 = 1754.04$ and that this value was statistically significant ($p <$

0.001). The Kaiser-Maiyer-Olkin (KMO) measure was high (0.92), which is above the cut-off value suggested by Pallant (2013, p. 193), therefore confirming the appropriateness of the data for further analysis.

This section provides evidence to support the reliability and the validity of the CIP Knowledge scales (Section 4.2.1.1) and the CIP Skills scales (Section 4.2.1.2).

4.2.1.1 Confidence in ICT Pedagogical (CIP) Knowledge Survey

Evidence to support the reliability of the CIP Knowledge Survey is reported in terms of the factor structure and internal consistency reliability.

Factor structure

Stevens' (1992) criteria for retaining an item were adopted for this study: items with factor loading of more than .40 on its *priori* scale and less than .40 on any other scale were retained. Principal axis factoring with oblique rotation was carried out to extract salient factors. When factor analysis was used to examine the factor structure of the three scales in the CIP Knowledge Survey, one item (Item 11 for the planning and communication knowledge scale – *Rate your ICT Knowledge when using it to communicate with parents*), did not meet the criteria for retention, that is, it fell below the cut-off criteria of .40 on its own factor and more than .40 on another scale, and was removed from all further analysis.

The factor loadings for the remaining 14 items, reported in Table 4.1, were all above .40 on their *a priori* scale and less than .40 on the other scales, with the lowest factor loading being .50. The percentage of variance, reported at the bottom of Table 4.1, was 7.19% for pedagogical knowledge, 55.56% for planning and communication knowledge and 9.13% for digital citizenship knowledge, with a total variance of 71.88%. The eigenvalues for the three scales were all greater than 1, the widely-accepted cut off recommended by Kaiser (1960).

Table 4. 1 Factor Loadings, Eigenvalues and Percentage of Variance for the CIP Knowledge Scales.

Item	**Factor Loading**		
	Pedagogical Knowledge	Planning and Communication Knowledge	Digital Citizenship
1	50		
2	.68		
3	.83		
4	.71		
5	.72		
6		.76	
7		.62	
8		.85	
9		.76	
10		.79	
12			.84
13			.70
14			.80
15			.77
% Variance	7.19	55.56	9.13
Eigenvalue	1.01	7.78	1.28

N = 163 teachers in 14 schools.
Factor loadings less than 0.40 were omitted from the table.
CIP Knowledge: Confidence in ICT Pedagogical Knowledge.

Internal consistency reliability

Cronbach's alpha coefficient, with both the individual and school mean as the unit of analysis, was calculated to provide a measure of internal consistency reliability for each of the three scales (pedagogical knowledge, planning and communication knowledge, digital citizenship knowledge). The Cronbach alpha coefficient, reported in Table 4.2 ranged from .87 to .91 for the individual as the unit of analysis and from .84 to .96 for the school mean as the unit of analysis. Given that Cronbach alpha coefficient for all factors were above .80, with three results above .90, these were considered to be highly satisfactory (Bland & Altman, 1997).

As with the CIP Knowledge Survey, analysis of the data pertaining to Confidence in ICT Pedagogical Skills confidence was conducted to examine the factor structure and internal consistency reliability of the instrument.

Table 4. 2 Internal Consistency Reliability (Cronbach Alpha Coefficient) for the CIP Knowledge Survey.

Scales	No of Items	Unit of analysis	Alpha Reliability
Pedagogical Knowledge	5	Individual	87
		School Mean	.95
Planning and Communication Knowledge	5	Individual	.91
		School Mean	.84
Digital Citizenship Knowledge	4	Individual	.87
		School Mean	.96

N = 163 teachers in 14 schools.

4.2.1.2 Confidence in ICT Pedagogical (CIP) Skills Survey

Factor structure

As with the CIP Knowledge Survey, principal axis factor analysis with oblique rotation was carried out to extract salient factors for the CIP Skills Survey. Factor analysis indicated that two items did not meet the criteria and were removed from all further analyses: Item 1 for the pedagogical skills scale – *Rate your confidence in your ICT skills when using it to respond to student's diverse backgrounds* and Item 11 for the planning and communication skills scale – *Rate your confidence in your ICT skills when using it to communicate with parents*.

For the remaining items, with one exception, the factor loadings reported in Table 4.3, were all above .40 on their *a priori* scale and less than .40 on the other scales. For item 2 for the pedagogical skills scale, the factor loadings were below .4 on its own and all other scales. Despite not satisfying the criteria, this item was retained as it added to the overall reliability of the scale. For all other items, the factor loadings were higher than .50. The percentage of variance reported in Table 4.3 was 8.01% for the pedagogical skills scale, 63.43% for the planning and communication skills scale and 10.27% for the digital citizenship skills scale, with a total variance of 81.71%. The eigenvalues for the three scales, also reported at the bottom of Table 4.3, were all greater than 1 as recommended by Kaiser (1960).

Table 4. 3 Factor Loadings, Eigenvalues and Percentage of Variance for the CIP Skills Survey.

Item	Factor Loading		
	Pedagogical Skills	Planning and Communication Skills	Digital Citizenship Skills
2	-		
3	.63		
4	.86		
5	.82		
6		.60	
7		.68	
8		.82	
9		.80	
10		.78	
12			.80
13			.69
14			.83
15			.86
% Variance	8.01	63.43	10.27
Eigenvalue	1.00	8.25	1.34

N = 163 teachers in 14 schools.

CIP Skills: Confidence in ICT Pedagogical Skills.

Internal consistency reliability

As with the CIP Knowledge scales, the internal consistency reliability for the three scales of the CIP Skills Survey were provided by calculating Cronbach's alpha coefficient for the individual and school mean as the unit of analysis. The Cronbach alpha coefficient, reported in Table 4.4, was .93 for all three scales with the individual as the unit of analysis and ranged from .96 to .97 with the school mean as the unit of analysis. Given that alpha coefficient for all factors were above .90, these were considered to be highly satisfactory (Bland & Altman, 1997).

Table 4. 4 Internal Consistency Reliability (Cronbach Alpha Coefficient) for the CIP Skills Survey.

Scales	No of Items	Unit of analysis	Alpha Reliability
Pedagogical Skills	4	Individual	.93
		School Mean	.96
Planning and Communication Skills	5	Individual	.93
		School Mean	.97
Digital Citizenship Skills	4	Individual	.93
		School Mean	.96

N = 163 teachers in 14 schools.

The results of the factor analysis and internal consistency reliability reported in this section provide evidence to suggest that the CIP Knowledge Survey and the CIP Skills Survey were valid and reliable when used with the sample of 163 teachers in South Australian schools.

4.2.2 Validity and Reliability of the Burnout, Efficacy and Satisfaction Survey (BESS)

Analysis of the data collected from the sample of 163 teachers was also used to provide support for the integrity and validity of the four scales of the BESS used to assess teachers' self-reports of: burnout; self-efficacy to influence decision making; self-efficacy when using ICT; and satisfaction with working with ICT. As with the CIP Knowledge Survey and the CIP Skills Survey, evidence to support the reliability and validity of all four scales of the BESS involved examining the factor structure and internal consistency reliability.

Factor structure

As a first step, principal axis factor analysis with oblique rotation was used to extract salient factors. Factor analysis indicated that four of the items were problematic and were omitted from all further analyses: Item 16 for the satisfaction with working with ICT scale (*At my school, using ICT how much can you do to get students to believe they can do well in school work?*) and Items 21 (*I don't really care what happens with some students*), 25 (*I can easily create a relaxed atmosphere at school*) and 26 (*In my work I deal with problems very calmly*) for the burnout scale.

The results, reported in Table 4.5, indicate that all the remaining items for all scales had a factor loading of at least .40 (with the lowest being .57) on their own scale and less than .40 on the other scales. The percentage variance varied from 8.07% to 37.71% for the different scales, with a total of 69.10% of the variance accounted for. The value of the eigenvalue ranged from 1.40 to 8.30 for the different scales which, based on Kaiser's (1960) 'greater than one' criterion for eigenvalue, was considered to be acceptable.

Table 4. 5 Factor Loadings, Eigenvalues, and % Variances for the BESS.

Item	Factor Loadings			
	Burnout	Self-efficacy to Influence Decision Making	Self-efficacy when using ICT	Satisfaction with working with ICT
1		.89		
2		.84		
3		.70		
4			.65	
5			.57	
6			.92	
7			.72	
8			.76	
9			.77	
10			.71	
11				.84
12				.85
13				.86
14				.81
15				.87
17	.85			
18	.85			
19	.89			
20	.82			
22	.59			
23	.76			
24	.70			
% Variance	16.96	6.36	8.07	37.71
Eigenvalue	3.73	1.40	1.78	8.30

N = 163 Teachers.
Items 16, 21, 25 and 26 have been omitted.
BESS: Burnout, Efficacy and Satisfaction Survey.

Internal consistency reliability

Cronbach's alpha coefficient was used to establish the internal consistency reliability for the BESS scales (Burnout, Self-efficacy to Influence Decision Making, Self-efficacy When Using ICT, and the Satisfaction with Working with ICT). Table 4.6 reports that internal consistency coefficients for each of the four scales. The results indicate the alpha coefficient for all four scales of the individual unit of analysis were above .80 with two results above .90. Furthermore, the results indicated that the alpha coefficient with the school mean as the unit of analysis was above .80 for three of the four scales and above .70 for the fourth scale. Nunnally and Bernstein's (1994) cut-off values for the alpha coefficient of at least .70 for satisfactory and a value of .80 for good was used. This analysis suggests the constructs are reliable.

Table 4. 6 Internal Consistency Reliability (Cronbach Alpha Coefficient) for the BESS

Scales	No of Items	Unit of Analysis	Alpha Reliability
Burnout	7	Individual	0.90
		School Mean	0.94
Self-efficacy to Influence Decision Making	3	Individual	0.80
		School Mean	0.84
Self-efficacy when using ICT	7	Individual	0.89
		School Mean	0.78
Satisfaction with working with ICT	5	Individual	0.95
		School Mean	0.92

N = 163 Teachers in 14 schools.
BESS: Burnout, Efficacy and Satisfaction Survey.

The results of the factor analysis and internal consistency reliability reported in this section provide evidence to suggest that the four scales of the BESS were valid when used with the sample of 163 teachers in South Australian schools.

4.3 Relationships between CIP Knowledge and Skills and Scales of the BESS

The second research objective was to investigate whether teachers' confidence, when using ICT with students, is related to teachers': burnout, self-efficacy to influence decision making; self-efficacy when using ICT; and satisfaction with working with ICT (BESS). The relationships between the four scales of the BESS and the CIP Knowledge and CIP Skills scales were examined using simple correlations and multiple regression analyses (see Chapter 3 for more details related to the analysis). CIP Knowledge and Skills scales were the independent variables and the BESS scales, constituted the dependent variables.

The following sections describe, first, the relationship between teachers' CIP Knowledge scales and the four BESS scales (Section 4.3.1) and, second, the relationships between teachers' CIP Skills scales and the four BESS scales (Section 4.3.2).

4.3.1 Relationship between CIP Knowledge Survey and BESS

This section reports results for the simple correlations and multiple regression analyses for the relationships between teachers' Confidence in ICT Pedagogical Knowledge (CIP Knowledge) and their self-reports of: burnout (Section 4.3.1.1); self-efficacy to influence decision making (Section 4.3.1.2); self-efficacy when using ICT (Section 4.3.1.3); and satisfaction with working with ICT (Section 4.3.1.4).

4.3.1.1 Associations between Burnout and CIP Knowledge

The results of the simple correlations between the three scales of the CIP Knowledge Survey and teacher burnout, reported in Table 4.7, indicate that two of the three CIP Knowledge scales (pedagogical knowledge, and planning and communication knowledge) has a small negative correlation with teachers' reports of burnout. However, none of the correlations were statistically significant.

As with the simple correlations, the multiple correlation (R) reported between the three scales and the burnout scale (R=.12) was not statistically significant. Further the beta values indicated that the independent relationships between burnout and the three scales were non-significant, suggesting that the teachers' confidence in ICT pedagogical knowledge was not associated with burnout.

4.3.1.2 Associations between Self-efficacy to Influence Decision Making and CIP Knowledge

The results, reported in Table 4.7, show that all three of the CIP Knowledge scales were positively and statistically significantly ($p < .01$) related to the self-efficacy to influence decision making scale. These results indicate that teachers feel that they have more self-efficacy to influence decision making related to ICT when using it, for example, to teach in creative ways, select digital content and promote digital citizenship.

The multiple correlation (R), reported at the bottom of Table 4.7, was 0.54 and statistically significant ($p < .01$). Interpretation of the beta values indicated that only one of the three CIP Knowledge scales, planning and communication knowledge, was

statistically significantly and independently ($p < .01$, *beta*=.33) related to self-efficacy to influence decision making. The relationship was positive, indicating that teachers' CIP Knowledge with respect to their ICT planning and communication was an independent predictor of their views of whether they were able to influence decision making.

Table 4. 7 Simple Correlation and Multiple Regression Analysis for Associations between CIP Knowledge Survey and BESS

CIP Knowledge Scales	**Associations with BESS**							
	Burnout		Self-efficacy to Influence Decision Making		Self-efficacy when Using ICT		Satisfaction with Working with ICT	
	r	*β*	*r*	*β*	*r*	*β*	*r*	*β*
Pedagogical Knowledge	-.02	.03	.46**	.16	.51**	.26**	.63**	.41**
Planning and Communication Knowledge	-.05	.12	.51**	.33**	.47**	.12	.59**	.25**
Digital Citizenship Knowledge	.05	.15	.42**	.11	.51**	.27**	.48**	.07
Multiple Correlation (*R*)		.12		.54**.		.57**		.66**

*$p < 0.05$ **$p < 0.01$
N = 163 teachers in 14 schools.

4.3.1.3 Associations between Self-efficacy when using ICT and CIP Knowledge

The simple correlations between the scales of the CIP Knowledge Survey and teachers' self-efficacy when using ICT reported in Table 4.7 indicate that all three scales in the CIP Knowledge Survey were positively and statistically significantly ($p < .01$) related to teachers' self-efficacy when using ICT.

The multiple correlation (*R*), reported at the bottom of Table 4.7, between the three CIP Knowledge scales and the self-efficacy when using ICT scale was .57 and was statistically significant ($p < .01$). Interpretation of the beta values indicated that two of the three CIP Knowledge scales, pedagogical knowledge (β =.26) and digital citizenship knowledge (β =.27), were positively, independently and statistically significantly ($p < .01$) related to self-efficacy when using ICT. These results suggest

greater confidence in ICT pedagogical knowledge and digital citizenship knowledge could lead to improved self-efficacy when using ICT.

4.3.1.4 Associations between Satisfaction with working with ICT and CIP Knowledge

The simple correlations between the scales of the CIP Knowledge Survey and teachers' satisfaction with working with ICT reported in Table 4.7 indicate that all three scales in the CIP Knowledge Survey were positively and statistically significantly ($p < .01$) related to teacher satisfaction with working with ICT.

The multiple correlation (R) reported at the bottom of Table 4.7 between the three CIP Knowledge scales and the satisfaction with working with ICT scale was .66 and was statistically significant ($p < .01$). Interpretation of the beta values indicated that two of the three CIP Knowledge confidence scales, pedagogical knowledge ($\beta = .41$) and planning and communication knowledge ($\beta = .25$) were positively, independently and statistically significantly ($p < .01$) related to teachers' self-reports of satisfaction. These results suggest that greater confidence in ICT pedagogical knowledge and ICT planning and communication knowledge could lead to improved satisfaction with working with ICT.

4.3.2 Relationship between CIP Skills Survey and BESS

The CIP Skills scales were developed to assess teachers' confidence in terms of staying up to date with technology, as well as their confidence in their ability to manage hardware, software, operating systems and specific programs. This section reports results for the simple correlations and multiple regression analyses for relationships between teachers' confidence with respect to their skills of using ICT and their self-reports of: burnout (Section 4.3.2.1); self-efficacy to influence decision making (Section 4.3.2.2); self-efficacy when using ICT (Section 4.3.2.3); and satisfaction with working with ICT (Section 4.3.2.4).

4.3.2.1 Associations between Burnout and Confidence in ICT Pedagogical Skills

The results of the simple correlation between the three sales of the CIP Skills Survey and teacher burnout as reported in Table 4.8 indicate that all three scales of the CIP Skills Survey were negatively correlated with the teachers' self-reports of burnout. As with CIP Knowledge scales, however, none of the correlations were statistically significant.

Furthermore, the multiple correlation (R) reported between the three scales and the burnout scale (R =.13) and beta values were not statistically significant. The findings suggest that the teachers' level of confidence in pedagogical skills needed to successfully use ICT was not associated with burnout.

4.3.2.2 Self-efficacy to Influence Decision Making – CIP Skills Associations

The results reported in Table 4.8 shows that all three of the CIP Skills scales were positively and statistically significantly ($p < .01$) correlated with self-efficacy to influence decision making. These results suggest that teachers who have more confidence with respect to their pedagogical skills, planning and communication skills and digital citizenship skills also report more self-efficacy to influence decision making.

The multiple correlation (R), reported in Table 4.8 for the three CIP Skills scales and the self-efficacy to influence decision making scale, was .55 and statistically significant ($p < .01$). Interpretations of the beta value indicated that only one of the CIP Skills scales, planning and communication skills was independently and statistically significantly ($p < .01$, $\beta = 0.51$) related to self-efficacy to influence decision making. The relationship was positive, indicating that teachers' confidence with respect to their planning and communication skills was an independent predictor of self-reports of their ability to influence decisions regarding technology use.

Table 4. 8 Simple Correlation and Multiple Regression Analysis for Associations between CIP Skills Survey and BESS

CIP Skills Scales	**Associations with BESS**							
	Burnout		Self-efficacy to Influence Decision Making		Self-efficacy when using ICT		Satisfaction with working with ICT	
	r	*β*	*r*	*β*	*r*	*β*	*r*	*β*
Pedagogical Skills	-.04	.08	.41**	-.07	.54**	.31**	.61**	.27**
Planning and Communication Skills	-.09	-0.21	.55**	.51**	.51**	.11	.64**	.42**
Digital Citizenship Skills	-.01	.08	.43**	.14	.50**	.23**	.46**	.01
Multiple Correlation (*R*)		.13		.55**		.58**		.66**

*$p < 0.05$ **$p < 0.01$
N = 163 teachers in 14 schools.

4.3.2.3 Associations between Self-efficacy when using ICT and CIP Skills

The simple correlations between the scales of the CIP Skills Survey and teachers' self-efficacy when using ICT reported in Table 4.8 indicate that all three scales in the CIP Skills Survey were positively and statistically significantly ($p < .01$) related to teachers' self-efficacy when using ICT.

The multiple correlation (*R*) reported at the bottom of Table 4.8 between the three skills scales and the self-efficacy when using ICT scale was .58 and was statistically significant ($p < .01$). The beta values indicated that two of the three CIP Skills scales, pedagogical skills ($\beta = .31$) and digital citizenship skills ($\beta = .23$) were positively, independently and statistically significantly ($p < .01$) related to self-efficacy when using ICT. These results suggest that more confidence in ICT pedagogical skills and digital citizenship skills could lead to improved self-efficacy when using ICT.

4.3.2.4 Associations between Satisfaction with working with ICT and CIP Skills

The simple correlation between the scales of the CIP Skills Survey and teachers' satisfaction with working with ICT reported in Table 4.8 indicate that all three scales in the CIP Skills Survey were positively and statistically significantly ($p < 0.01$) related to teachers' satisfaction.

The multiple regression *(R)* reported at the bottom of Table 4.8 between the three CIP Skills scales and the satisfaction with working with ICT scale was 0.66 and was statistically significant ($p < .01$). Similar to pedagogical knowledge, satisfaction had the strongest multiple correlation ($R = .66$) with CIP Skills, suggesting that teachers who are more confident about their pedagogical ICT skills also report more satisfaction with working with technology. Interpretation of the beta value indicated that two of the three scales, pedagogical skills ($\beta = .27$) and planning and communication skills ($\beta = .42$) were positively, independently and statistically significantly ($p < .01$) related to self-reports of satisfaction with working with ICT. The results suggest that those teachers who are more confident in their ICT pedagogical skills and planning and communication skills are also more satisfied when working with technology.

4.4 Sex, Age and Frequency of Technology Use as Determinants of Confidence, Burnout, Self-efficacy and satisfaction

The third objective of my study was to investigate whether teachers' reports of their confidence in ICT knowledge and skills and their sense of burnout, self-efficacy and satisfaction differed for: male and female teachers; teachers in different age groups; and teachers who used technology for different amounts of time.

To address this research objective, as explained in Chapter 3, the 10 dependent variables (made up of three CIP Knowledge scales, three CIP Skills scales and the four scales of the BESS) would have been used to perform a single multivariate analysis of variance (MANOVA). However, given that the number of teachers was limited (N=163), it was not considered meaningful to include all 10 dependent variables in a single analysis. Therefore, separate MANOVAS were performed for: the CIP Knowledge scales, CIP Skills scales; and BESS scales.

Not all of the MANOVAs yielded statistically significant results in terms of Wilks' lambda criterion. In these cases, although the ANOVAs are reported, these were not statistically significant. For those MANOVAs which did yield statistically significant results ($p < .01$) in terms of Wilks' lambda criterion, indicating that there were differences in the set of criterion variables as a whole, the univariate ANOVAs were interpreted.

Whereas the MANOVA provided information about the statistical significance of the differences between the different groups, effect sizes were used to provide information about the magnitude of the differences. Effect size is the difference in means expressed in standard deviation units and was calculated using the formula: $d= M_1-M_2/\sqrt{[(\sigma_1^2+\sigma_2^2)/2]}$. According to Tabachnick and Fidell (2013), effect size can be described as the "set of statistics that indicates the relative magnitude of the differences between means, or the amount of the total variance in the dependent variable that is predictable from knowledge of the levels of the independent variable" (Pallant, 2013, p. 218). The following sections reports on the results using the following headings: sex differences (Section 4.4.1); age differences (Section 4.4.2); and frequency of IT use (Section 4.4.3).

4.4.1 Sex Differences

The results for the sex differences (MANOVA and effect sizes) are reported below for: CIP Knowledge Survey (Section 4.4.1); CIP Skills Survey (Section 4.4.2); and BESS (Section 4.4.1.3).

4.4.1.1 Sex differences for CIP Knowledge Survey

The Wilks' lambda was not statistically significant, indicating that the data provide little evidence to suggest differences in the CIP Knowledge reported by males and females. The average item means, reported in the left-hand column of Table 4.9, indicated that females scored slightly higher than their male counterparts for two of the CIP Knowledge scales: pedagogical knowledge (mean = 3.66) and planning and communication knowledge (mean = 3.89). Whilst the data indicated a slight lean towards females holding higher knowledge confidence in technology use, males and females held similar views for digital citizenship knowledge. Interestingly, the digital citizenship knowledge scale was scored lowest of the three scales by both males and females. Figure 4.1 shows in graphical form the narrow differences between males and females across all three of the CIP Knowledge scales. The effect sizes reported in Table 4.9 also reflected the limited difference in scores for males and females. For all three

of the CIP Knowledge scales these were small, ranging from 0.04 to 0.01 standard deviations.

Table 4. 9 Average Item Mean, Average Item Standard Deviation and Male–Female Differences (Effect Size and ANOVA) for CIP Knowledge Survey

CIP Knowledge Scales	Average Item Mean		Average Item Standard Deviation		Differences	
	Male	Female	Male	Female	Effect Size	*F*
Pedagogical Knowledge	3.63	3.66	0.74	0.81	-0.04	0.06
Planning and Communication Knowledge	3.86	3.89	0.77	0.80	-0.04	0.05
Digital Citizenship Knowledge	3.38	3.37	0.84	0.97	0.01	0.01

N= 163 Teachers. *N*= 47 Male and 116 Female teachers.
Effect size is the difference in means expressed in standard deviation units and was calculated using the formula: $d= M_1-M_2/\sqrt{[(\sigma_1^2+\sigma_2^2)/2]}$

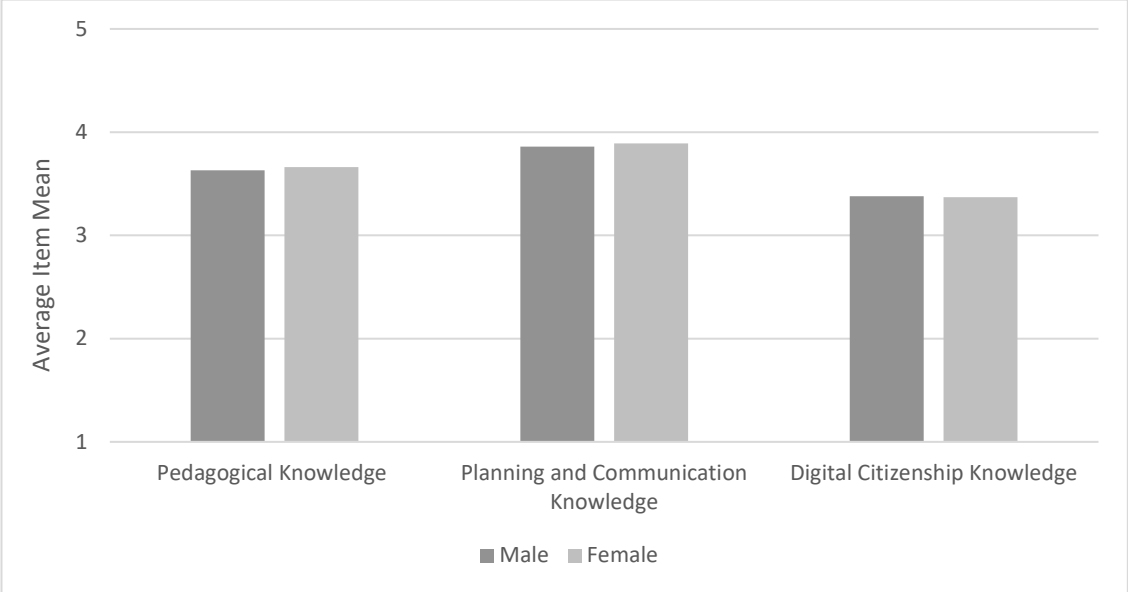

Figure 4. 1 Average Item Mean for Males and Females for CIP Knowledge Survey

4.4.1.2 Sex Differences for CIP Skills Survey

The average item means, reported in the left-hand column of Table 4.10 and portrayed graphically in Figure 4.2, indicated that females scored slightly higher than their male counterparts for two of the CIP Skills scales: pedagogical skills and planning and communication skills. Conversely, confidence in digital citizenship skills was slightly

higher for males than females. As with the CIP Knowledge scales, the Wilks' lambda for the CIP Skills scales was not statistically significant, indicating that levels of confidence reported by males and females were similar. The effect sizes, calculated to provide an estimate of the magnitude of the differences, reported in Table 4.10, were small for all three skills CIP Skills scales, ranging from 0.07 to 0.15. Figure 4.2 shows, in graphical form, the narrow differences between males and females for pedagogical skills, planning and communication skills and digital citizenship skills.

Table 4. 10 Average Item Mean, Average Item Standard Deviation and Male–Female Differences (Effect Size and ANOVA) for CIP Skills Survey

CIP Skills Scales	**Average Item Mean**		**Average Item Standard Deviation**		**Differences**	
	Male	Female	Male	Female	Effect Size	*F*
Pedagogical Skills	3.60	3.66	0.76	0.84	-0.07	0.17
Planning and Communication Skills	3.77	3.83	0.78	0.83	-0.07	0.17
Digital Citizenship Skills	3.45	3.30	0.95	1.10	0.15	0.60

N= 163 Teachers. *N*= 47 Male and 116 Female teachers.
Effect size is the difference in means expressed in standard deviation units and was calculated using the formula: $d= M_1-M_2/\sqrt{[(\sigma_1^2+\sigma_2^2)/2]}$

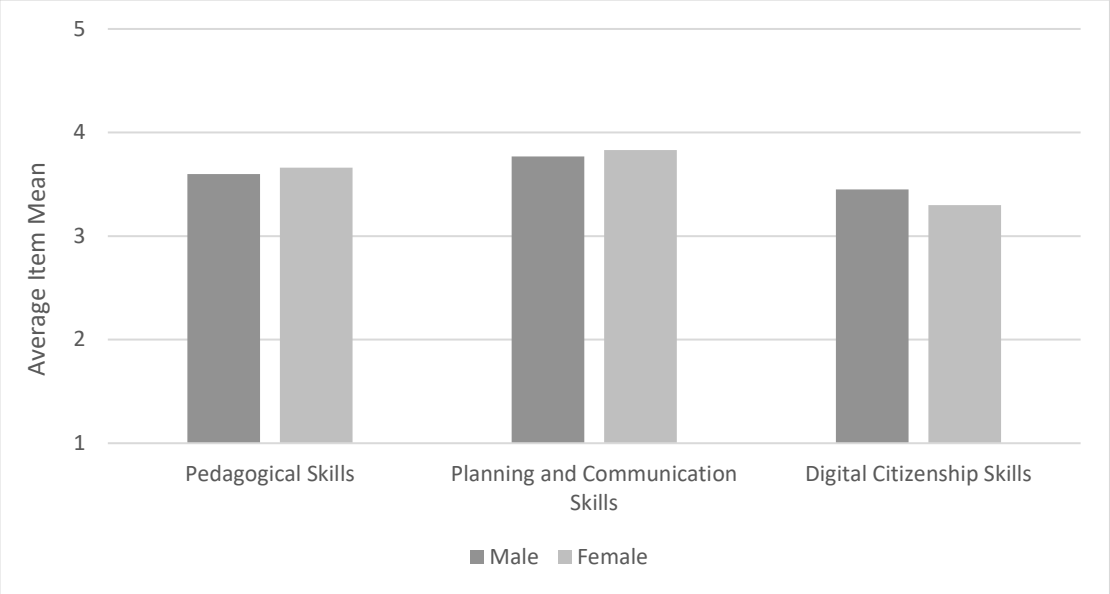

Figure 4. 2 Average Item Mean for Males and Females for CIP Skills Survey.

4.4.1.3 Sex differences for Burnout, Self-efficacy to Influence Decision Making, Self-efficacy when using ICT and Satisfaction with working with ICT (BESS)

The difference between males and females for the four scales of the BESS are reported in Table 4.11 and Figure 4.3. The average item means, reported in the left-hand columns of Table 4.11, indicated that males scored marginally higher than females in all four scales (burnout, self-efficacy to influence decision making, self-efficacy when using ICT, and satisfaction with working with ICT). Both males and females reported their lowest scores on burnout and highest on satisfaction with working with ICT. Wilks' lambda was not statistically significant, indicating that the data provide little evidence of differences in the impact of technology use for males and females. Interestingly, despite the nonsignificant MANOVA results, there was a statistically significant difference ($p < .05$) for males and females for the self-efficacy to influence decision making scale, with males reporting more positive self-efficacy when using ICTs than their female counterparts. The effect sizes, which ranged from 0.03 to 0.37 standard deviations were also small, reflecting the non-significant MANOVA result.

Male and female self-efficacy to influence decision making, self-efficacy when using ICT, and satisfaction with working with ICT scales were relatively similar and relatively high with scores 3.17 and above.

Across the four scales of the BESS, the satisfaction with working with ICT scale recorded the highest mean for both males (mean score = 3.90) and females (mean score = 3.81). Conversely, the impact scale that recorded the lowest mean for both males (mean score = 2.40) and females (mean score 2.35) was the burnout scale. Figure 4.3 shows in graphical form the narrow difference between males and females for the four scales of the BESS.

Table 4. 11 Average Item Mean, Average Item Standard Deviation and Male–Female Differences (Effect Size and ANOVA) for BESS

BESS Scale	Average Item Mean		Average Item Standard Deviation		Differences	
	Male	Female	Male	Female	Effect Size	*F*
Burnout	2.40	2.35	0.75	0.82	0.06	0.11
Self-efficacy to Influence Decision Making	3.48	3.17	0.90	0.79	0.37	4.72*
Self-efficacy when using ICT	3.54	3.52	0.56	0.61	0.03	0.05
Satisfaction with working with ICT	3.90	3.81	0.80	0.83	0.11	0.36

N= 163 Teachers. *N*= 47 Male and 116 Female teachers.
*$p < 0.05$
Effect size is the difference in means expressed in standard deviation units and was calculated using the formula: $d= M_1-M_2/\sqrt{[(\sigma_1^2+\sigma_2^2)/2]}$

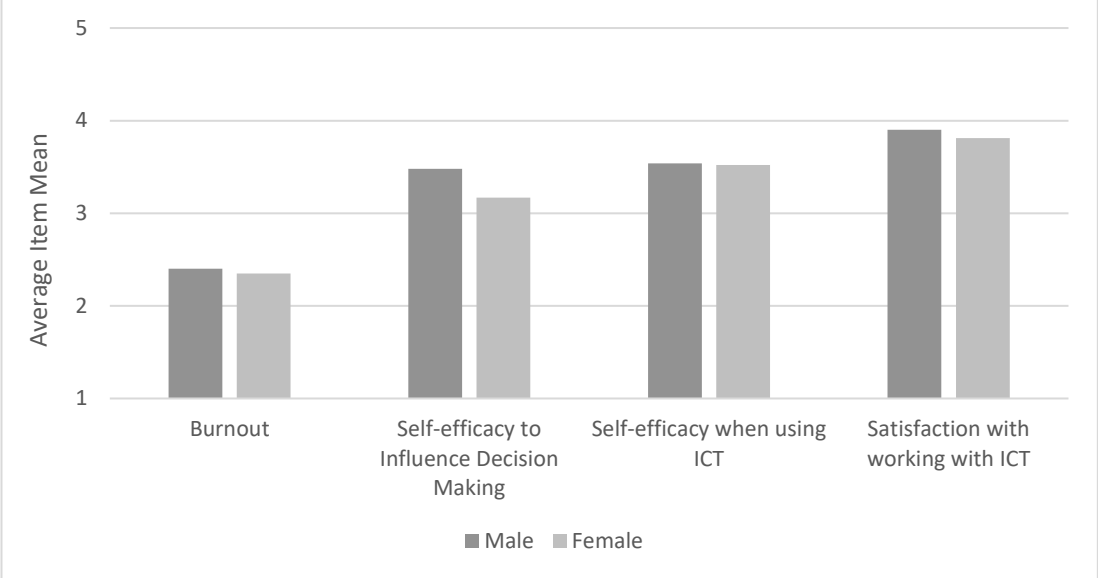

Figure 4. 3 Average Item Mean for Males and Females for BES Survey.

4.4.2 Age Differences

The data collected from 163 teachers were used to examine whether teachers' confidence in ICT pedagogical knowledge and pedagogical skills and self-reports of burnout, efficacy and satisfaction differed for different age groups. Three age groups were used in this study; less than 35 years old, (*n*=47 teachers), 35 to 54 years old (*n*=77 teachers) and more than 54 years old (*n*=39 teachers).

Given that the MANOVA yielded a statistically significant result ($p < .01$) in terms of Wilks' lambda criterion for all three confidence scales, the univariate ANOVAs were interpreted. To examine which pairs of age groups were significantly different, Tukey's HSD multiple comparison procedure was used. The results are reported below for: CIP Knowledge scales (Section 4.4.2.1); CIP Skills scales (Section 4.4.2.2); and teachers' burnout, efficacy and satisfaction with working with ICT (Section 4.4.2.3).

4.4.2.1 CIP Knowledge Survey and Age Differences

The average item mean and average item standard deviations for the three CIP Knowledge scales, reported in Table 4.12 and portrayed graphically in Figure 4.4, indicated that teachers less than 35 years of age reported the highest levels of confidence for all three scales. Conversely, teachers greater than 54 years of age reported the lowest levels of CIP Knowledge.

The univariate ANOVA results reported in Table 4.12 indicate that, between all age groups, there were statistically significant *($p < .05$)* differences in teachers' self-reports for all three of CIP Knowledge scales.

Table 4. 12 Average Item Mean, Average Item Standard Deviation and Age Group Differences (Effect Size and ANOVA Results) for the CIP Knowledge Survey

CIP Knowledge Scales	**Average Item Mean**			**Average Item Standard Deviation**			**Difference**
	< 35 years	35 - 54 years	> 54 years	< 35 years	35-54 years	> 54 years	*F*
Pedagogical Knowledge	3.91	3.57	3.48	0.78	0.83	0.66	3.96*
Planning and Communication Knowledge	4.14	3.79	3.76	0.82	0.79	0.71	3.49*
Digital Citizenship Knowledge	3.65	3.27	3.23	0.81	0.83	1.20	3.06*

*p < 0.05
N = 163 Teachers.
47 teachers less than 35 years of age, 77 teachers aged between 35 and 54 and 39 older-than-54 years.

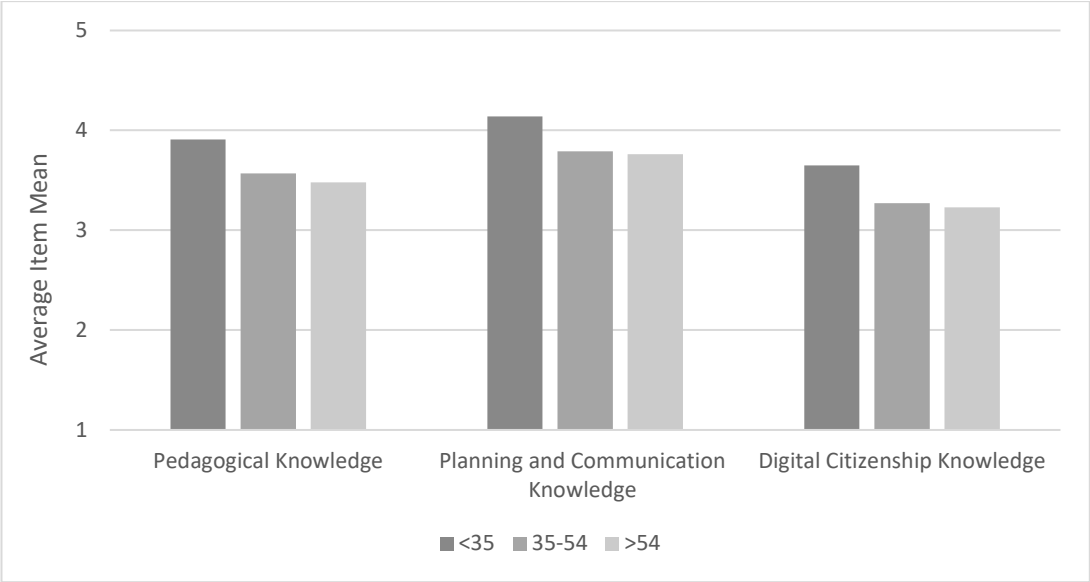

Figure 4. 4 Average Item Mean for Different Age Groups for the CIP Knowledge Survey.

To interpret the statistically significant between-age group differences in scale scores, identified through the ANOVAs (reported in Table 4.12), Tukey's HSD multiple comparison procedure was carried out for each scale. The asterisks in Table 4.13 indicate for which scales, using Tukey's HSD procedure, pairwise comparisons of age groups were statistically significant. Whilst there were no statistically significant differences between the two older age groups (35 to 54 years and greater than 54 years), there were differences between the other pairs.

For all three of the CIP Knowledge scales, there was a statistically significant difference between the confidence of teachers less than 35 and those 35 to 54 years: pedagogical knowledge (effect size = 0.42 standard deviations); planning and communication knowledge (effect size = 0.43 standard deviations) and digital citizenship knowledge (effect size = 0.46 standard deviations). In all cases, the less than 35 age group reported more CIP Knowledge than the 35 to 54 age group. The effect sizes, reported in Table 4.13, indicate that the magnitude of the differences is, according to Cohen's (1988) criteria, moderate.

Table 4. 13 Effect Size and Tukey's HSD Multiple Comparison for Statistical Significance of Difference Between each Pair of Ages for CIP Knowledge Survey.

CIP Knowledge Scales	Effect Size & Tukey HSD		
	<35 & 35-54yrs	35-54 ->54yrs	<35 - >54yrs
Pedagogical Knowledge	0.42*	0.12	0.60*
Planning and Communication Knowledge	0.43*	0.04	0.50
Digital Citizenship Knowledge	0.46*	0.04	0.41*

*p<0.05, **p<0.01
N=47 teachers less than 35 years of age, 77 teachers aged between 35 and 54 and 39 older-than-54 years.
Effect size is the difference in means expressed in standard deviation units and was calculated using the formula: $d= M_1-M_2/\sqrt{[(\sigma_1^2+\sigma_2^2)/2]}$

Differences between teachers younger than 35 and those older than 54 years were statistically significant for two of the three knowledge confidence scales: pedagogical knowledge (effect size = 0.60 standard deviations) and digital citizenship knowledge (effect size = 0.41 standard deviations). Again, for both scales, those teachers in the less than 35 age group reported more knowledge confidence than their peers older than 54 years. Interestingly, the effect sizes indicate that the magnitude of these differences were, according to Cohen's criteria, large.

4.4.2.2 CIP Skills Survey and Age Differences

As with CIP Knowledge, the average item mean and average item standard deviation for the three CIP Skills scales, reported in Table 4.14 and portrayed graphically in Figure 4.5, indicated that teachers aged less than 35 years reported the highest levels of confidence for all three scales. Conversely, teachers greater than 54 years of age reported the lowest levels of skills confidence.

The univariate ANOVA results, reported in Table 4.14, indicate that there were statistically significant ($p < .05$) differences in teachers' self-reports for two of the CIP Skills scales: pedagogical skills and planning and communication skills.

Table 4. 14 Average Item Mean, Average Item Standard Deviation and Age Group Differences (Effect Size and ANOVA) Results for the CIP Skills Survey

CIP Skills Scales	Average Item Mean			Average Item Standard Deviation			Difference
	< 35 years	35 - 54 years	> 54 years	< 35 years	35-54 years	> 54 years	*F*
Pedagogical Skills	3.95	3.54	3.53	0.84	0.83	0.73	4.24**
Planning and Communication Skills	4.07	3.73	3.71	0.88	0.80	0.72	2.84*
Digital Citizenship Skills	3.64	3.31	3.10	0.90	0.98	1.32	2.76

**p < 0.01 *p < 0.05
N = 163 Teachers.
47 teachers less than 35 years of age, 77 teachers aged between 35 and 54 and 39 older than-54 years.

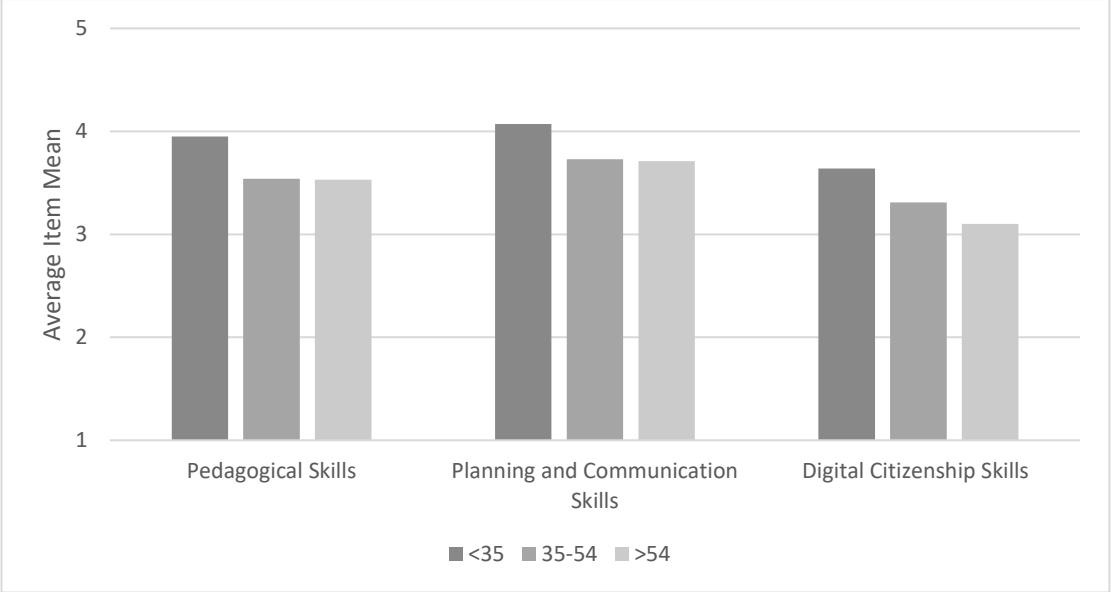

Figure 4. 5 Average Item Mean for Different Age Groups for Responses to the CIP Skills Survey

Tukey's HSD multiple comparison procedure was used to ascertain the statistical significance of differences between pairs of age groups for each scale. The asterisks in Table 4.15 indicate for which scales, using Tukey's HSD procedure for the pairwise comparison of age groups, differences were statically significant. In addition, the effect sizes are also reported in Table 4.15 for each scale. As with the CIP Knowledge Survey, there were no statistically significant differences between the two older age groups (35 to 54 years and greater than 54 years). The pairwise post hoc comparisons for those statistically significant differences ($p < .05$) are reported below.

Table 4. 15 Effect Size and Tukey's HSD Multiple Comparison for Statistical Significance of Difference Between each Pair of Ages for CIP Skills Scales.

CIP Skills Scales	Effect Size & Tukey HSD		
	<35and 35-54	35-54 ->54	<35 - >54
Pedagogical Skills	0.49*	0.01	0.53*
Planning and Communication Skills	0.40*	0.02	0.44*
Digital Citizenship Skills	0.35	0.18	0.47*

*p<0.05
N=47 teachers less than 35 years of age, 77 teachers aged between 35 and 54 and 39 older than-54 years.
Effect size is the difference in means expressed in standard deviation units and was calculated using the formula:
$d= M_1-M_2/\sqrt{[(\sigma_1^2+\sigma_2^2)/2]}$

Differences between the less than 35 age group and 35 to 54 years age group were statistically significant difference for two of the three scales: pedagogical Skills (effect size = 0.49 standard deviations) and planning and communication skills (effect size = 0.40 standard deviations). In all cases, teachers less than 35 years reported more CIP skills than their older counterparts. The effect sizes indicate that the magnitude of the differences was, according to Cohen's criteria, moderate.

Comparing the less than 35 age group and the greater than 54 age group, there was a statistically significant difference for all three scales in the CIP Skills Survey: pedagogical skills (effect size = 0.53 standard deviations), planning and communication skills (effect size = 0.44 standard deviations), and digital citizenship skills (effect size = 0.47 standard deviations). Again, for all three scales, the less than 35 age group reported more CIP skills than teachers older than 54. The magnitude of these differences was, according to Cohen's criteria, large.

4.4.2.3 Burnout, Efficacy and Satisfaction (BESS) and Age Differences

The average item means and average item standard deviations for each of the four scales of the BESS are reported in Table 4.16 and portrayed in Figure 4.6. Generally, the less than 35 age group recorded higher scores for most of the scales and the more than 54 age group recorded the lowest scores for most of the scales.

Table 4. 16 Average Item Mean, Average Item Standard Deviation and Age Group Differences (Effect Size and ANOVA) Results for the BESS.

BES Scales	Average Item Mean			Average Item Standard Deviation			Difference
	< 35 years	35 - 54 years	> 54 years	< 35 years	35-54 years	> 54 years	*F*
Burnout	2.57	2.28	2.31	0.80	0.75	0.86	2.10
Self-efficacy to Influence Decision Making	3.30	3.34	3.05	0.85	0.81	0.87	1.53
Self-efficacy when using ICT	3.61	3.53	3.41	0.63	0.54	0.64	1.28
Satisfaction with working with ICT	4.00	3.86	3.59	0.94	0.77	0.71	2.58

N = 163 Teachers.
47 teachers less than 35 years of age, 77 teachers aged between 35 and 54 and 39 older than-54 years

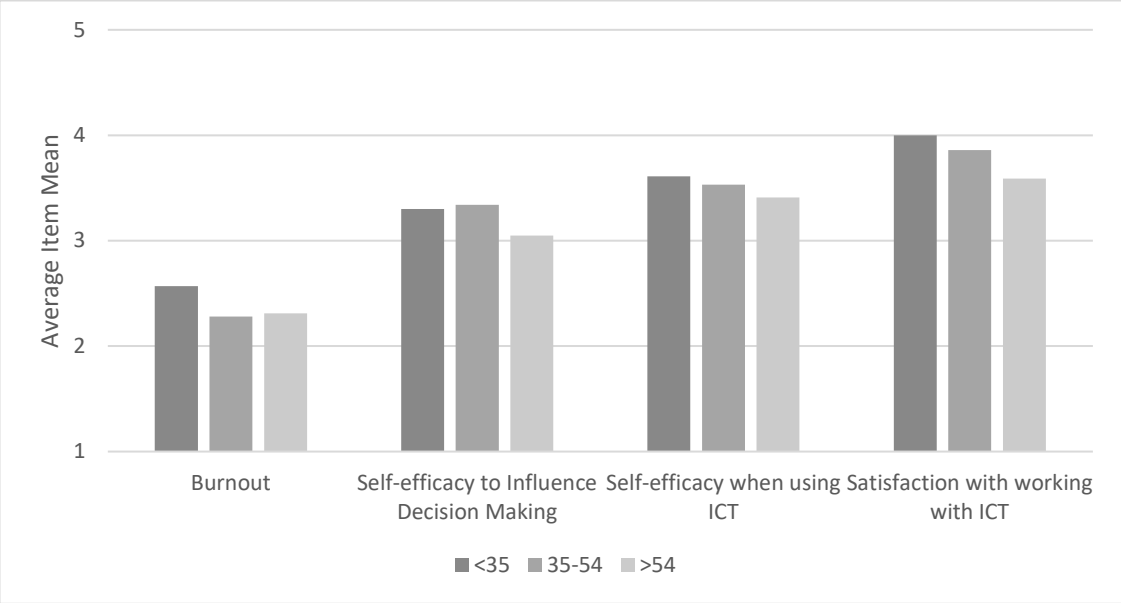

Figure 4. 6 Average Item Mean for Different Age Groups for Responses to the BESS.

Examination of the scores in Figure 4.6 indicates that, overall, teachers scored highest for the satisfaction with working with ICT scale and lowest for the burnout scale. It is worth noting that no age group reached a score of 4.00 on any of the scales. It is also worth noting that, for the burnout scale, higher scores equate to higher levels of burnout. Whilst all age groups generally reported reasonably low levels of burnout (2.28 – 2.57) it is interesting to note that the less than 35 years of age group scored the highest for this variable.

Despite these differences in the average item mean for the four scales in the BESS for each of the three age groups, the univariate ANOVA results, reported in the right-hand column of Table 4.16 indicate that none of these differences between age groups were statistically significant.

4.4.3 Frequency of ICT use

The data collected from 163 teachers were used to examine whether teachers who used technology for varying lengths of times (hours of use) differed in terms of their confidence in ICT pedagogy (both knowledge and skills) and their self-reports of burnout, self-efficacy to influence decision making, self-efficacy when using ICT, and satisfaction with working with ICT. Four frequencies of use were used in this study: less than 11 hours per week (18 teachers), 11 to 20 hours per week (66 teachers), 21 to 30 hours per week (54 teachers) and greater than 30 hours per week (25 teachers).

When the MANOVA yielded a statistically significant result ($p<.01$) in terms of Wilks' lambda criterion for all CIP Knowledge scales and CIP Skills scales, the univariate ANOVAs were interpreted. To examine between which pairs of frequencies of using technology differences were statistically significant, Tukey's HSD multiple comparison procedure was used. The results are reported below for CIP Knowledge scales (see Section 4.4.3.1); CIP Skills scales (Section 4.4.3.2); and teachers' burnout, efficacy, and satisfaction (Section 4.4.3.3) with hours of use difference.

4.4.3.1 CIP Knowledge and Frequencies

The average item mean and average item standard deviations for the three CIP Knowledge scales are reported in Table 4.17. The results, portrayed graphically in Figure 4.6, indicated that teachers using technology more than 30 hours a week reported the highest levels of confidence for all CIP Knowledge scales. Conversely teachers using technology less than 11 hours per week reported the lowest levels of confidence for all CIP Knowledge scales (pedagogical knowledge = 3.27; planning and communication knowledge = 3.60; digital citizenship knowledge = 2.93). The univariate ANOVA results, reported in Table 4.17 indicate that, across all hours of

technology groups, there were statistically significant *($p < .05$)* differences in teachers self-reports for all three CIP Knowledge scales.

Table 4. 17 Average Item Mean, Average Item Standard Deviation and Frequencies of Using IT Differences (Effect Size and ANOVA) for CIP Knowledge Scales.

CIP Knowledge Scales	**Average Item Mean**				**Average Item Standard Deviation**				**Difference**
	<11 hours	11-20 hours	21-30 hours	>30 hours	<11 hours	11-20 hours	21-30 hours	>30 hours	*F*
Pedagogical Knowledge	3.27	3.60	3.67	4.01	0.66	0.77	0.79	0.85	3.28**
Planning and Communication Knowledge	3.60	3.76	4.00	4.14	0.79	0.77	0.73	0.89	2.62*
Digital Citizenship Knowledge	2.93	3.23	3.56	3.63	0.82	0.95	0.87	0.97	3.30*

N= 18 teachers using IT less than 11 hours a week, 66 teachers using IT for 11-20 hours a week, 54 teachers using IT 21-30 hours a week, 25 teachers using IT for greater than 30 hours a week
***p*<0.01 **p*<0.05

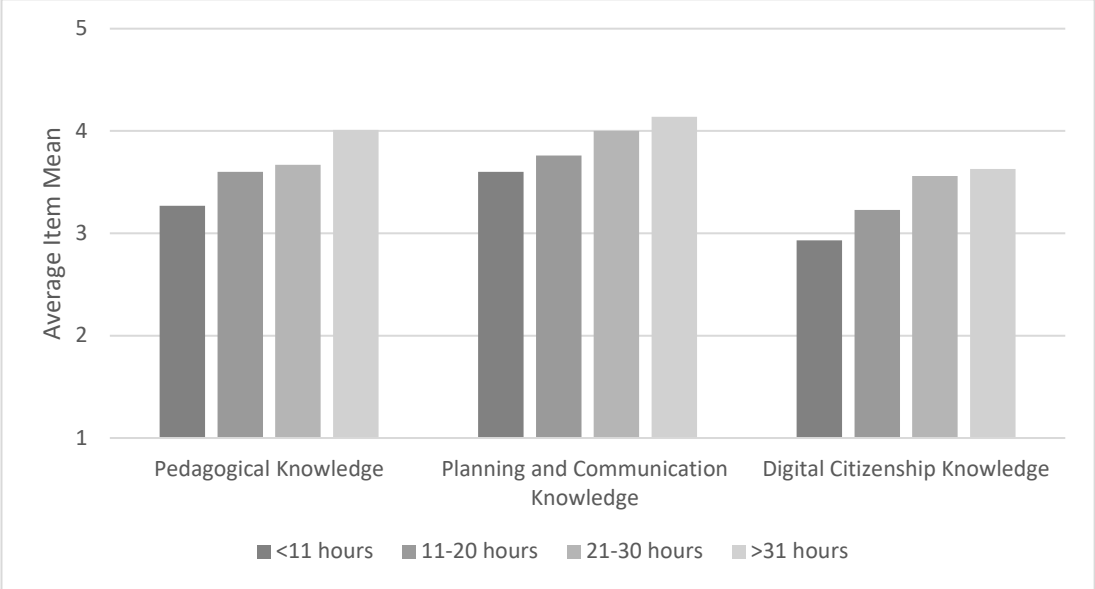

Figure 4. 7Average Item Mean for the Different Frequencies of IT Use for the CIP Knowledge Survey

Tukey's HSD multiple comparison procedure was carried out to ascertain the statistical significance of differences between frequencies of IT use (e.g. between the less than11 hours and 11 to 20 hours groups) for each scale. The asterisks in Table 4.18 indicate for which of the scales, using Tukey's HSD procedure, pairwise comparisons frequencies of use were statistically significant. There were no statistically significant

differences between pairs of the four smallest frequencies (less than 11 hours and 11-20 hours; 11 – 20 and 21 – 30 hours; 21 – 30 and greater than 30 hours).

For all of the CIP Knowledge scales, there was a statistically significant difference between teachers who use technology less than11 hours and those teachers who used technology for more than 30 hours: pedagogical knowledge (effect size = 0.97 standard deviations); planning and communication knowledge (effect size = 0.64 standard deviations); and digital citizenship knowledge (effect size = 0.78 standard deviations). In all cases, the teachers who used technology for more than 30 hours a week reported more confidence than those using technology for less than 11 hours weekly. The effect sizes, reported in Table 4.18 indicate that the magnitude of the differences was, according to Cohen's criteria, moderate.

Table 4. 18 Effect Size and Tukey's HSD Multiple Comparison for Statistical Significance of Difference Between each Pair of Frequencies of Use for CIP Knowledge Scales.

	Effect Size & Tukey HSD					
CIP Knowledge Scales	<11 and 11-20 hours	11-20 and 21-30 hours	21-30 and >30 hours	<11 and 21-30 hours	<11 and >30 hours	11-20 and >30 hours
Pedagogical Knowledge	0.46	0.09	0.41	0.55	0.97*	0.51*
Planning and Communication Knowledge	0.21	0.32	0.17	0.53	0.64*	0.46*
Digital Citizenship Knowledge	0.34	0.36	0.07	0.75*	0.78*	0.42

N= 18 teachers using IT less than11 hours a week, 62 teachers using IT for 11-20 hours a week, 54 teachers using IT 21-30 hours a week, 25 teachers using IT for greater than 30 hours a week
*$p < 0.05$

For two of the CIP Knowledge scales, there were statistically significant differences between teachers who used technology between 11 to 20 hours and those who used technology for more than 30 hours group: pedagogical knowledge (effect size = 0.51 standard deviations) and planning and communication knowledge (effect size = 0.46 standard deviations. For all three scales the greater than 30 hours of use group reported more confidence in ICT pedagogical knowledge than the 11 – 20 hours of use group. The effect sizes indicate that the magnitude of these differences was, according to Cohen's criteria, large.

4.4.3.2 CIP Skills and Frequency of Use

The average item mean and average item standard deviation for the three CIP Skills scales, reported in Table 4.19 and portrayed graphically in Figure 4.8, indicated that teachers using technology for more than 30 hours a week reported higher levels of skills confidence for all CIP Skills scales (pedagogical Skills = 4.01; planning and communication skills = 4.16; digital citizenship skills = 3.57). On the other hand, teachers using technology for less than 11 hours per week reported the lowest levels of skills confidence (pedagogical skills = 3.31; planning and communication skills = 3.37; digital citizenship skills = 2.96).

The univariate ANOVA results reported in Table 4.19 indicate that there were statistically significant ($p < .05$) differences between frequencies of technology use in teachers' self-reports for two of the CIP Skills scales: pedagogical skills and planning and communication skills.

Table 4. 19 Average Item Mean, Average Item Standard Deviation and Frequencies of Using IT Differences (Effect Size and ANOVA) for CIP Skills Scales.

CIP Skills Scales	**Average Item Mean**				**Average Item Standard Deviation**				**Difference**
	<11 hours	11-20 hours	21-30 hours	>30 hours	<11 hours	11-20 hours	21-30 hours	>30 hours	*F*
Pedagogical Skills	3.31	3.56	3.70	4.01	0.72	0.73	0.91	0.84	3.03*
Planning and Communication Skills	3.37	3.72	3.93	4.16	0.86	0.78	0.80	0.76	3.97**
Digital Citizenship Skills	2.96	3.20	3.57	3.57	0.77	1.07	1.10	1.03	2.34

N= 18 teachers using IT less than 11 hours a week, 66 teachers using IT for 11-20 hours a week, 54 teachers using IT 21-30 hours a week, 25 teachers using IT for greater than 30 hours a week
**p<0.01 *p<0.05

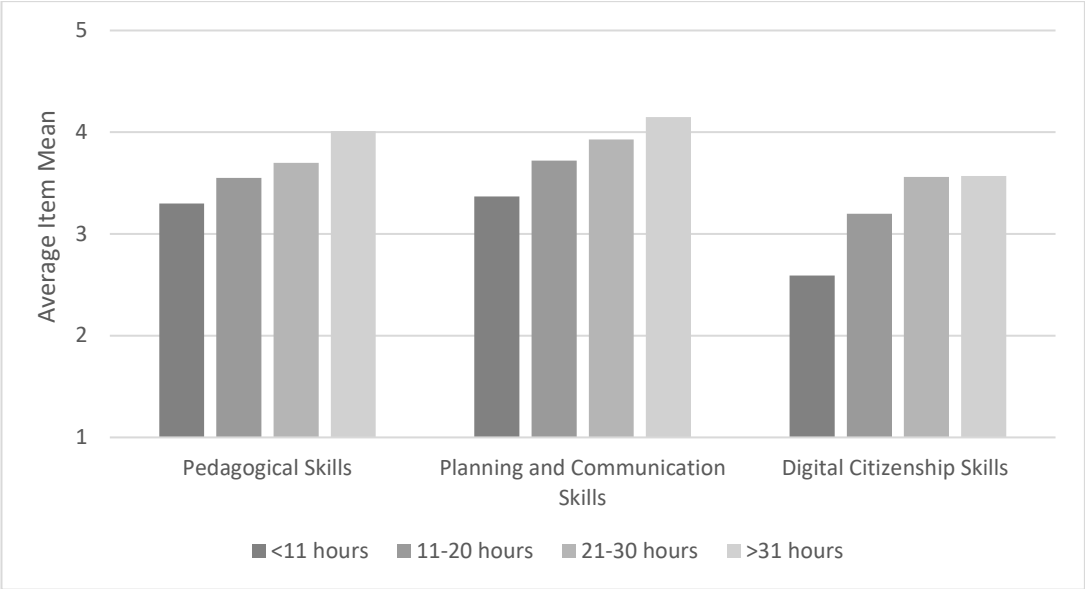

Figure 4. 8 Average Item Mean for Different Frequencies of Use for Responses to the CIP Skills Survey.

Tukey's HSD multiple comparison procedure was used to ascertain the statistical significance of differences between two pairs of frequencies of use groups for each scale. The asterisks in Table 4.20 indicate for which scales, using Tukey's HSD procedure, pairwise comparisons of frequencies of use groups were statistically significant. In addition, the effect sizes are also reported in Table 4.20 for each scale. As with the CIP Knowledge Survey, there were no statistically significant differences between pairs of the three frequencies of use groups (less than 11 and 11 – 20 hours of use; 11 – 20 and 21 – 30 hours of use groups; 21 – 30 and greater than 30 hours of use groups). The pairwise post hoc comparisons, for those statistically significant differences ($p < .05$) are reported below.

Table 4. 20 Effect Size and Tukey's HSD Multiple Comparison for Statistical Significance of Difference Between each Pair of Frequencies of use for CIP Skills Scales.

	Effect Size & Tukey HSD					
CIP Skills Scales	<11 and 11-20 hours	11-20 and 21-30 hours	21-30 and >30	<11 and 21-30	<11 and >30	11-20 and >30
Pedagogical Skills	0.34	0.17	0.35	0.50	0.89*	0.57*
Planning and Communication Skills	0.43	0.27	0.29	0.57*	0.97*	0.57*
Digital Citizenship Skills	0.25	0.34	0.00	0.35	0.67	0.35

*$p<0.05$,
N= 18 teachers using IT less than 11 hours a week, 66 teachers using IT for 11-20 hours a week, 54 teachers using IT 21-30 hours a week, 25 teachers using IT for greater than 30 hours a week
Effect size is the difference in means expressed in standard deviation units and was calculated using the formula: $d= M_1-M_2/\sqrt{[(\sigma_1^2+\sigma_2^2)/2]}$

The less than 11 and 21 to 30 hours groups was a statistically significantly different for one scale: planning and communication skills (effect size = 0.57 standard deviations). Between the less than 11 and greater than 31 hours of use groups there was a statistically significant difference for two scales: pedagogical skills (effect size = 0.89 standard deviations), planning and communication skills (effect size = 0.97). Likewise, the 11 to 20 and greater than 30 hours of use groups were statistically significantly different for the same two scales: pedagogical skills (effect size = 0.57) and planning and communication skills (effect size = 0.57). In all cases, the greater than 30 hours of use group reported more confidence. The effect sizes indicate that the magnitude of the differences was, according to Cohen's criteria, moderate.

4.4.3.3 Burnout, Efficacy, Satisfaction (BESS) and Frequency of Use

The average item means reported in Table 4.21 for different frequencies of using ICT indicated that, generally teachers reporting more hours of using technology had higher scores for self-efficacy to influence decision making at school and satisfaction with working with ICT. Figure 4.9 depicts in graphical form the mean values of each of the outcome scales for different frequencies of using technology by teachers. The ANOVA results suggest that statistically significant differences between frequencies

of use were found for two of the four scales; self-efficacy to influence decision making and satisfaction with working with ICT.

Table 4. 21 Average Item Mean, Average Item Standard Deviation and Frequencies of Using ICT Differences (Effect Size and MANOVA) Results for the BESS.

BESS Scales	Average Item Mean				Average Item Standard Deviation				Difference
	< 11 hours	11-20 hours	21-30 hours	> 30 hours	< 11 hours	11-20 hours	21-30 hours	> 30 hours	*F*
Teacher Burnout	2.26	2.27	2.48	2.47	0.77	0.65	0.85	0.99	0.96
Self-efficacy to Influence Decision Making	3.00	3.03	3.47	3.57	0.72	0.65	0.83	1.12	4.69**
Self-efficacy when using ICT	3.49	3.42	3.62	3.60	0.69	0.56	0.52	0.72	1.17
Satisfaction with working with ICT	3.43	3.73	3.95	4.18	0.69	0.87	0.73	0.86	3.80**

**p<.01
N=163 Teachers.
N= 18 teachers using IT less-than-11 hours a week, 66 teachers using IT for 11-20 hours a week, 54 teachers using IT 21-30 hours a week, 25 teachers using IT for greater than 30 hours a week

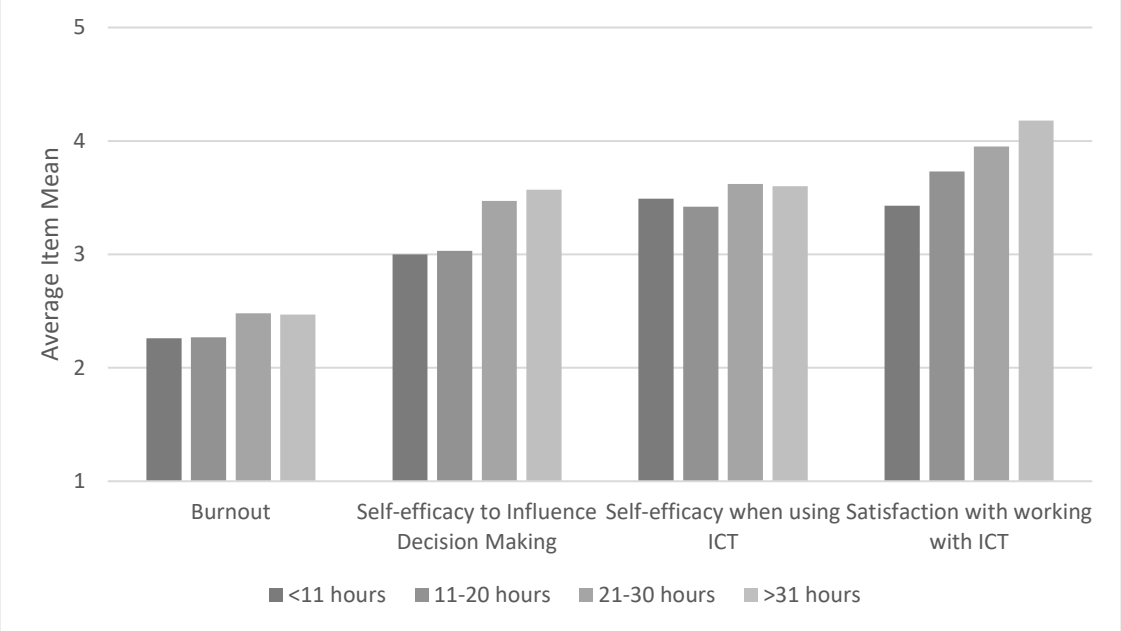

Figure 4. 9 Average Item Means for Different Frequencies of Using Technology for BESS Scales

To ascertain the statistically significant differences between each pair of frequencies, Tukey's HSD multiple comparison procedure was carried out. For self-efficacy to influence decision making, the differences between using technology for between 11

and 20 hours and for more than 20 hours (21 to 30 and more than 30 hours) were statistically significant. For satisfaction, the only statistically significant difference was for those people who used technology for less than 11 hours and for those who used it for more than 30 hours a week. In all cases, the more hours for which teachers used technology, higher too were scores for self-efficacy to influence decision making and satisfaction.

Table 4. 22 Effect Size and Tukey's HSD Multiple Comparison for Statistical Significance of Difference Between each Pair of Frequencies of Using Technology for BESS

	Effect Size & Tukey HSD				
BESS Scales	<11 and 11-20 hours	11-20 and 21-30 hours	21-30 and >30 hours	<11 and >30 hours	11 – 20 and >30 hours
Burnout	0.01	0.28	0.01	0.24	0.24
Self-efficacy to Influence Decision Making	0.04	0.59*	0.10	0.61	0.59*
Self-efficacy when using ICT	0.11	0.37	0.03	0.16	0.28
Satisfaction with working with ICT	0.38	0.27	0.29	0.96*	0.52

*p<0.05
N=47 teachers less than-35 years of age, 77 teachers aged between 35 and 54 and 39 older than 54 years.
Effect size is the difference in means expressed in standard deviation units and was calculated using the formula: $d= M_1-M_2/\sqrt{[(\sigma_1^2+\sigma_2^2)/2]}$

4.5 Chapter Summary

This chapter reported the results of the analyses undertaken to address each of the three research objectives. This section summarises these findings.

To address research objective one, evidence was furnished to support the validity and reliability, the factor structure and internal consistency reliability were examined. Once the appropriateness of the data had been determined, principal axis factor analysis with oblique rotation was used to examine the factor loadings of each of the three scales. Those items with factor loading of more than .40 on its *priori* scale and less than .40 on any other scale were retained. For both confidence surveys (CIP knowledge and CIP skills) this led to slightly refined versions. For the CIP Knowledge Survey, one items was removed. The remaining fourteen items all met the criteria, loading at .40 on their three *a priori* scales and no other scale. Further, the percentage of variance and eigenvalues both supported the adequacy of the factors. For the CIP Skills Survey, two items were removed and the remaining 13 items, with one

exception, loaded at .40 on its *a priori* scale and no other scale. The exception (which did not load on its own or any other scale at .40) was retained as it contributed to the reliability overall. The internal consistency reliability for the scales of the two confidence surveys (CIP Knowledge Survey and CIP Skills Survey) all were above .84. The evidence provided to support both the CIP Knowledge and CIP Skills Surveys suggest that they were valid and reliable when used with the sample of 163 teachers in South Australian schools.

Factor analysis and internal consistency reliability were also used to examine the integrity and validity of the four scales of the Burnout, Efficacy and Satisfaction Survey (BESS). The results of the principal axis factor analysis with oblique rotation led to a refined version of the BESS with a total of 22 items in four scales. All of the remaining items loaded, at .40, on their *a priori* scale and no other scale. The internal consistency reliability, calculated using Cronbach's alpha coefficient, with the individual unit of analysis was above .80 for all four scales. Together, the results of the factor analysis and internal consistency reliability provided evidence to support the reliability and validity of the BESS when used with the sample of 163 teachers.

The second research objective was to investigate whether teachers' confidence when using ICT with students was related to teachers' sense of burnout, efficacy and satisfaction. These are reported for the CIP Knowledge Survey and for the CIP Skills Survey.

For the CIP Knowledge Survey, two of the three scales (pedagogical knowledge and planning and communication knowledge) had small negative correlations with teachers' reports of burnout. None of the correlations were statistically significant for the associations between burnout and CIP knowledge. The multiple correlations reported between the three scales and the burnout scale ($R = .12$) was not statistically significant. Similarly, the beta values indicated that the independent relationships between burnout and the three scales were non-significant indicating that teachers' confidence in ICT pedagogical knowledge is not associated with burnout.

All three CIP Knowledge scales were positively and statistically significantly ($p < .01$) related to self-efficacy to influence decision making and self-efficacy when using ICT.

The interpretation of the beta values indicated that one of the three CIP Knowledge scales was statistically, significantly and independently related to self-efficacy to influence decision making. However, two of the three CIP Knowledge scales (pedagogical knowledge and digital citizenship knowledge) were positively, independently and statistically related to self-efficacy when using ICT suggesting that greater confidence in ICT pedagogical knowledge and digital citizenship could lead to improved self-efficacy when using ICT.

The multiple correlation of the three CIP Knowledge scales and the satisfaction with working with ICT scale was statistically significant ($p < .01$). The beta values indicated that two of the three CIP Knowledge confidence scales were positively, independently and statistically significantly related to teachers' self-reports of satisfaction.

For the CIP Skills Survey all three scales were negatively correlated with teachers' burnout with none of the correlations being statistically significant. Findings suggest that teachers' level of confidence in pedagogical skills is not associated with burnout.

All three of the CIP Skills scales were positively and significantly ($p < .01$) correlated with self-efficacy to influence decision making and self-efficacy when using ICT. The beta value for the CIP skills indicated that only one scale (planning and communications skills) was independently and statistically significantly related to self-efficacy to influence decision making. On the other hand, beta values indicated that two of the three CIP Skills scales (pedagogical skills and digital citizenship skills) were positively, independently and statistically significant ($p < .01$) related to self-efficacy when using ICT.

The final research objective was to investigate whether teachers' reports of their: confidence (CIP Knowledge and CIP Skills); burnout, efficacy and satisfaction with working with ICT (BESS) differed for: male and female teachers; teachers in different age groups; and teachers who used technology for different frequencies. Taking into consideration that the number of teachers for this study was limited (N=163), separate MANOVAS were performed for each survey and, in some cases, the ANOVAs were interpreted. Furthermore, effect sizes were used to provide information about the magnitude of the differences.

The results indicated that there were no statistically significant differences in the CIP knowledge and the CIP skills of males and females. The difference between males and females for the four scales of the BESS indicated that there was a statistically significant ($p < .05$) difference for only one of the four BESS scales, self-efficacy to influence decision making (effect size = 0.37 standard deviations).

Three age groups were used in this study; less than 35 years old, 35 to 54 years old and more than 54 years old. Tukey's HSD multiple comparison procedure was used to examine which pairs of age groups were statistically significant. For the CIP Knowledge Survey, there were statistically significant ($p < .01$) differences between age groups. Specifically, there were differences for all three CIP knowledge scales for the less than 35 group and both of the other age groups (35 to 54 years and over 54 years); with the under 35 age group reporting more confidence for all three scales. For the CIP Skills Survey, there were similar trends, with teachers who were under 35 years reporting statistically significantly more confidence than both of the other age groups (35 to 54 and over 35). For the BESS scales, there were no statistically significant differences between any of the age groups.

Four groups of hours of use were used in this study; less than 11 hours per week, 11 to 20 hours per week, 21 to 30 hours per week and greater than 30 hours per week. Tukey's HSD multiple comparison procedure was used to examine which pairs of hours of using technology were statistically significant. For the CIP knowledge scales, the findings indicated that there was a statistically significant difference for all three scales, for teachers using technology for more than 30 hours and those using technology for less than 20 hours a week. In all cases, teachers who used technology for longer had more confidence in their knowledge of ICT as measured by the CIP Knowledge Survey. Similarly, the results of the CIP Skills Survey indicated that teachers who used technology more than 30 hours reported statistically significantly more confidence for two of the three scales (pedagogical skills and planning and communication skills) than teachers who used technology for less than 20 hours. For the BESS, there were statistically significant ($p < .01$) differences for two of the four scales (self-efficacy to influence decision making and satisfaction with working with ICT). The results of Tukey's HSD multiple comparison procedure indicated that, teachers who use ICT for more than 11 to 20 hours reported statistically significantly

less self-efficacy to influence decision making than teachers who use ICT for 21 hours or more. Also, teachers using technology for more than 30 hours a week reported statistically significantly higher levels of satisfaction with ICT than those who used ICT for less than 11 hours a week.

In the next chapter, the discussion of these results is provided. Furthermore, the limitations of the study are highlighted followed by a summary of recommendations and a description of the significance of the study.

Chapter 5

DISCUSSION

5.1 Introduction

The increase in access to ICT (Technology) devices has long impacted teachers (Ertmer & Ottenbreit-Leftwich, 2010; Kimber, Pillay & Richards, 2013), students (Buchannan, 2011; Christensen & Knezek, 2008) and schools (White, 2008). Past research has found that burnout (Maslach & Leiter, 1997), self-efficacy (Bandura, 2006; O'Neil & Stephenson, 2011), and satisfaction (Dinham & Scott, 1996) are related to teacher confidence. This study builds on these by examining how burnout self-efficacy, and satisfaction are related to teacher confidence specifically with ICT use in the classroom.

Data were collected using three specifically designed instruments; the Confidence in ICT Pedagogical Knowledge Survey (CIP Knowledge); the Confidence in ICT Pedagogical Skills Survey (CIP Skills); and the Burnout, Efficacy and Satisfaction with Working with ICT Survey (BESS). The CIP Knowledge and the CIP Skills each have 15 items, and a five-response category scale that measures teachers' confidence in ICT knowledge and teachers' confidence in ICT skills. The BESS is a 38-item, five-response survey that measures teachers' burnout, self-efficacy to influence decision making, self-efficacy when using ICT and satisfaction with working with ICT. The three surveys were completed by 163 teachers from 14 South Australian secondary schools.

This chapter concludes this thesis by summarising the results detailed in Chapter 4 and providing limitations, recommendations and significance of this study. The chapter begins with a discussion of the findings (Section 5.2). This is followed by a description of the limitations of the study (Section 5.3) and the summary of recommendations (Section 5.4). The significance of the study is described in Section 5.5 and the chapter concludes with the final remarks (Section 5.6).

5.2 Discussion of the Findings

This section provides a summary of the key findings and a discussion for each of the research objectives along with recommendations for future research. The validity and reliability of the three surveys are described in Section 5.2.1. The relationship of teachers' CIP Knowledge and CIP Skills with BESS is described in Section 5.2.2. Differences in CIP knowledge, CIP skills and BESS according to teachers' sex, age and time spent using technology is described in Section 5.2.3

5.2.1 Validity and reliability of instruments

The first research objective was to provide evidence to support the reliability and validity of the three surveys that were developed for use in the present study to assess:

a. Confidence in ICT Pedagogical Knowledge (CIP Knowledge Survey);
b. Confidence in ICT Pedagogical Skills (CIP Skills Survey); and
c. Teachers' burnout; self-efficacy to influence decisions, self-efficacy when using ICT and satisfaction with working with ICT (BES Survey).

The data collected from 177 teachers from secondary schools in South Australia were used to provide evidence for the reliability and validity of the CIP Knowledge Survey, the CIP Skills Survey and the BESS in terms of their factor structure and internal consistency reliability. The results are summarised separately for the CIP Knowledge and the CIP Skills (Section 5.2.1.1) and the BESS (Section 5.2.1.2).

5.2.1.1 Validity and reliability of the CIP Knowledge and the CIP Skills Surveys

To provide evidence to support the validity and reliability of the CIP Knowledge Survey and the CIP Skills Survey, the data were analysed in two ways. As a first step, Bartlett's test of sphericity was used to evaluate the factorability of the data. Secondly, Cronbach's alpha coefficient was calculated to provide a measure of internal consistency reliability for each of the three scales: pedagogical knowledge, planning and communication knowledge, digital citizenship knowledge and, pedagogical skills, planning and communication skills and digital citizenship skills.

Key findings for the validity and reliability of the CIP Knowledge Survey are summarised below:

- 14 of the 15 items in the CIP Knowledge Survey displayed satisfactory factorial validity with a factor loading of at least 0.50 on their own scale and less than 0.40 on all other scales. The eigenvalues for all three scales were greater than 1 as recommended by Kaiser (1960). Item 11 did not meet the criteria or retention and was removed.
- The internal consistency reliability for each of the three scales, calculated using Cronbach alpha reliability, ranged from 0.87 to 0.91.

Key findings of the validity and reliability of the CIP Skills Survey are summarised below:

- 13 of the 15 items in the CIP Skills Survey displayed satisfactory validity with a factor loading of at least 0.60 on their own scale and less than 0.40 on all other scales. The eigenvalues for all three scales were all greater than 1 as recommended by Kaiser (1960). Items 1 and 11 did not meet the criteria and were removed.
- The internal consistency reliability for the three scales calculated using Cronbach alpha reliability, ranged from 0.96 to 0.97.

The CIP Knowledge and CIP Skills Surveys were designed based on the Technology Pedagogy Content Knowledge (TPACK) Confidence Survey as discussed by Albion, Jamieson-Proctor and Finger (2010). The validity of TPACK has been reported by several researchers (see, for example, Abbitt, 2011; Albion et al., 2010; Jamieson-Proctor, Albion, Finger, Cavanagh, Fitzgerald, Bond & Grimbeek, 2013; Koehler, Shin & Mishra, 2011) as a sound and reliable instrument.

Both the CIP Knowledge Survey and the CIP Skills Survey proved to be reliable and valid for this study. However, there is room for improvement. The CIP knowledge and skills' stems were identical, resulting in very similar results and making it difficult to differentiate from confidence in ICT pedagogical knowledge and confidence in ICT pedagogical skills. As a new instrument further development could include;

- grouping the stems according to more relatable categories, for example;
    - students;
    - colleagues;
    - school administration;
    - parents.
- removing the groupings (pedagogical, planning and communication and digital citizenship) and combining them to make one scale in the CIP Knowledge Survey and one scale in CIP Skills Survey.

It is recommended that the CIP Knowledge and CIP Skills instruments used in this study be modified and used in studies with a wider sample *(Recommendation #1).*

5.2.1.2 Validity and reliability of the BESS

As with the CIP Knowledge and CIP Skills surveys, the factor structure and reliability of the BESS were examined.

The BESS was designed by modifying and combining three scales: Maslach's (1996) Burnout Inventory; Bandura's (2006) self-efficacy scale; Aldridge and Fraser's (2016) satisfaction scale. The BESS was found to be reliable and valid for use in this research. Further development of this survey is recommended, including:

- The stems for self-efficacy to influence decision making were limited in number and narrowed the results. In particular it is recommended that access to resources, which is a barrier to integrating ICT in the classroom (see, for example, Arouri, 2013; Hew & Brush 2007; Kopcha, 2012), has its own set of items.
- Because there is limited research on teachers' satisfaction with working with ICT. It would be of value to broaden the satisfaction items to include satisfaction towards ICT Professional Development (Viel-Ruma, Houchins, Jolivette & Benson, 2010) and satisfaction with ICT resources (Lawrence, & Tar, 2018).

It is recommended that future studies using the BESS include measurements of ICT resources (personnel, professional and digital) *(Recommendation #2).*

5.2.2 Relationship between teachers' CIP Knowledge and CIP Skills with BESS.

Teachers' confidence with technology use was measured with two surveys: Confidence in ICT Pedagogical (CIP) Knowledge and Confidence in ICT Pedagogical (CIP) Skills. The second research objective was to investigate whether teachers' CIP knowledge and CIP skills, when using digital devices with students, are related to teachers':

a. Burnout.
b. Efficacy:
    - Self-efficacy to influence decision making scale
    - Self-efficacy when using ICT scale.
c. Satisfaction with working with ICT.

All scales of the CIP Knowledge and CIP Skills were related positively to both teacher efficacy scales (self-efficacy to influence decision making and self-efficacy when using ICT) and with the satisfaction with working with ICT scale. Two scales of the CIP Knowledge Survey (pedagogical knowledge and planning and communication knowledge) were negatively related to burnout, whilst one sub-scale of the CIP Knowledge Survey (digital citizenship knowledge) was positively related to burnout. All scales of the CIP Skills Survey were negatively related to burnout. The key findings are summarised below for both the CIP Knowledge Survey and the CIP Skills Survey.

Confidence in ICT Pedagogical (CIP) Knowledge:

The following summarises the statistically significantly correlated associations for the CIP Knowledge Survey with the BESS.

Pedagogical knowledge correlations and associations are:

- Self-efficacy
    - to influence decision making (r = .46**, β = .16, p<.01)
    - when using ICT (r = .51**, β = .26**, p<.01)
    - Satisfaction with working with ICT (r = .63**, β = .41**, p<.01)

Planning and communication knowledge correlations and assoications are:

- Self-efficacy
    - to influence decision making (r = .51**, β = .33**, p<.01)

- when using with ICT (r = .47**, β = .12, p<.01)
- Satisfaction with working with ICT (r = .59**, β = .25**, p<.01)

Digital citizenship scale correlations and assoications are:

- Self-efficacy
  - to influence decision making (r = .42**, β = .11, p<.01)
  - when using ICT (r = .51**, β = .27**, p<.01)
  - Satisfaction with working with ICT (r = .48**, β = .07, p<.01)

Confidence in ICT Pedagogical (CIP) Skills

The following summarises the statistically significantly correlated associations for the CIP Skills Survey with the BESS.

Pedagogical skills correlations and assoications are:

Self-efficacy

- to influence decision making (r = .41**, β = -.07, p<.01)
- when using ICT (r = .54**, β = .31**, p<.01)

- Satisfaction with working with ICT(r = .61**, β = .27**, p<.01)

Planning and communication skills correlations and assoications are:

Self-efficacy

- to influence decision making (r = .55**, β = .51**, p<.01)
- when using ICT (r = .51**, β = .11,)

Satisfaction with working with ICT (r = .64**, β = .42**, p<.01)

Digital citizenship skills correlations and assoications are:

- Self-efficacy
  - to influence decision making (r = .43**, β = .14, p<.01)
  - when using ICT (r = .50**, β = .23** p<.01)
- Satisfaction (r = .46**, β = .01, p<.01)

Given that there were very similar associations for both the CIP Knowledge Survey and CIP Skills Survey, these findings are discussed in terms of the following associations:

- Teachers' CIP Knowledge and CIP Skills and Burnout (Section 5.2.2.1).
- Teachers' CIP Knowledge and CIP Skills and Self-efficacy to influence decision making (Section 5.2.2.2);

- Teachers' CIP Knowledge and CIP Skills and Self-efficacy when using ICT (Section 5.2.2.3);
- Teachers' CIP Knowledge and CIP Skills and Satisfaction when working with ICT (Section 5.2.2.4).

5.2.2.1 Associations between Teachers' CIP Knowledge and CIP Skills and Burnout

None of the CIP Knowledge and CIP Skills correlations with teacher burnout were statistically significant. This outcome is in line with Ter Hoeven, van Zoonen and Fonner (2016), who suggest that the advantages are comparable to the disadvantages of communication technology use when it comes to the effect on burnout. It is important to note that the burnout items for my study were worded without any reference to technology or ICT. For example: *I feel emotionally drained at school; I feel burned out from my work; I feel fatigued when I get up in the morning and have to face another day at school.* A future version of this survey could include the specific reference to ICT use. For example; *I feel emotionally drained at school when I am using ICT; I feel burned out from using ICT at school; I feel fatigued when I get up in the morning and have to face another day of using ICT at school.* It is recommended that a future version of the BESS contain statements directly related to ICT use and burnout *(Recommendation #3).*

5.2.2.2 Associations between Teachers' CIP Knowledge and CIP Skills and Self-efficacy to Influence Decision Making

All three of the CIP Knowledge scales and all three of the CIP Skills scales were related positively and statistically significantly to self-efficacy to influence decision making. However, the beta values suggest that for both CIP Knowledge and CIP Skills, only planning and communication was statistically significantly and independently related to self-efficacy to influence decision making. Teacher confidence and self-efficacy are factors that contribute to the level of technology integration by teachers in the classroom (Wang, Ertmer & Newby, 2014). The results in this study suggests that to improve teachers' self-efficacy with influencing decisions made about ICT, teachers need more pedagogical, planning and communication and digital citizenship knowledge and skills.

Pedagogical knowledge confidence and pedagogical skills confidence are concerned with pedagogical content and the ability the teacher has to interpret, adapt and tailor subject matter (Koehler, Greenhalgh, Rosenberg & Keenan, 2017). Hennessy (2006) describes this as a set of pedagogical themes used to enhance existing teaching practices, particularly among teachers who are less confident in using ICT. Planning and communication knowledge confidence and planning and communication skills confidence are important elements of teacher professional practice (Albion, Jamieson-Proctor & Finger, 2010). Digital citizenship knowledge and skills are concerned with parents and digital responsibility (Jamieson-Proctor, Albion, Finger, Cavanagh, Fitzgerald, Bond & Grimbeek, 2013). These three elements, pedagogy, planning and communication and digital citizenship are significant when working to build teachers' confidence with ICT through opportunities of exploration, familiarisation and some organisational change (Hennessy, 2006). As confidence in using ICT increases, teachers' self-efficacy towards ICT improves (Wang et al., 2014). It is recommended that schools adopt professional learning opportunities that support teachers' development of technology infused pedagogy that enhances current practice *(Recommendation #4).*

5.2.2.3 Teachers' CIP Knowledge and CIP Skills – Self-efficacy when using ICT associations

CIP Knowledge and CIP Skills were measured using the scales of pedagogical, planning and communication and digital citizenship. All three of the CIP Knowledge scales and the CIP Skills scales were related positively and statistically significantly to self-efficacy when using ICT. The beta value for both indicated that pedagogical (knowledge and skills) and digital citizenship (knowledge and skills) were positively, independently and statistically significantly related to self-efficacy when using ICT.

Correlations in this study suggest that stronger confidence in each of these scales (pedagogical, planning and communication and digital citizenship) improves self-efficacy when using ICT. Self-efficacy when using ICT was measured using items specifically focussed on teachers' self-beliefs about students; for example, *when using ICT, I can; keep students on task; motivate students; get students to work together*. Teachers' self-efficacy in their capabilities to achieve certain tasks (Bandura, 1977)

powerfully influences the effort, challenges and perseverance teachers need to effectively instruct, manage and engage students (Lemon, 2016; Pfitzner-Eden, 2016). Of Bandura's (1986, 1997) four sources of self-efficacy (mastery experiences, vicarious experiences, social/verbal persuasion, and physiological emotional states) mastery experiences provide teachers with an understanding of both their success and their failures, with successful experiences increasing self-efficacy and unsuccessful experiences lowering self-efficacy (Pfitzner-Eden, 2016). A strong sense of self-efficacy towards teaching with technology to facilitate student learning (Ertmer & Ottenbreit-Leftwich, 2010) is linked to teacher confidence with integrating technology in the classroom (Wang et al., 2014).

It is reasonable to suggest that, when teachers have successful mastery experiences with using technology, they are more likely to integrate technology, thus building their pedagogical confidence (Pfitzner-Eden, 2016), their planning and communication confidence (Lemon, 2016; Albion, et al., 2010) and their digital citizenship confidence (Ertmer et al., 2010). It is recommended that schools adopt opportunities for professional learning that engage teachers in successful mastery experiences with using ICT *(Recommendation #5).*

5.2.2.4 Associations between Teachers' CIP Knowledge and CIP Skills and Satisfaction with working with ICT associations

The correlations gathered for this study indicate that teachers' satisfaction with working with ICT is improved when there is greater pedagogical, planning and communication and digital citizenship ICT confidence. Sappey and Relf (2010) suggest that workplace technologies influence work satisfaction. Teacher work satisfaction for this research was measured using statements such as; *At my school, I enjoy working with ICT; working with ICT is personally satisfying; I would like to continue working with ICT.* Dinham and Scott (1997, 2000) found that developing professional knowledge and skills was one of the most satisfying aspects of teaching, whilst educational change was one of the most dissatisfying. The introduction of technology use in the classroom could be perceived as educational change (Lawrence & Tar, 2018). Satisfaction with teaching has been linked to curriculum knowledge, pedagogical skills and classroom management (Rots, 2012). Aldridge and Fraser

(2016) assert that the approachability and supportive nature of the principal contributes directly and indirectly to teachers' job satisfaction. Because the lack of literature pertaining directly to teachers' satisfaction with working with ICT suggests the need to expand this field, it is recommended that further research is conducted into the relationship between teachers' satisfaction and technology use *(Recommendation #6).*

5.2.3 Differences between teachers' CIP Knowledge, CIP Skills and BESS according to teacher sex, age and hours using technology

The third research objective focused on whether confidence levels, burnout, efficacy, and satisfaction with working with ICT differed for:

a. Male and female teachers;
b. Teachers of different ages; and
c. Teachers who use technology for different amounts of time (Frequency of use).

In order to examine each determinant, separate MANOVAS were performed for: the CIP Knowledge scales, CIP Skills scales; and BESS scales. As not all of the MANOVAs yielded statistically significant results in terms of Wilks' lambda criterion. the univariate ANOVAs were interpreted. Whereas the MANOVA provided information about the statistical significance of the differences between the different groups, effect sizes were used to provide information about the magnitude of the differences. Furthermore, to examine which pairs were significantly different, Tukey's HSD multiple comparison procedure was used.

The key findings are summarised below:

CIP Knowledge and Skills and sex

- Males and females held similar scores across all three scales in the CIP Knowledge Survey and all three scales in the CIP Skills Survey.
- Females reported higher confidence than males.
- Males and females' confidence were relatively high with scores above 3.30
- The effect size was small (-.4 to .15 standard deviations), indicating small difference between male and female confidence.
- There was a non-significant difference between male and female self-efficacy and satisfaction.

- Males and females' levels of self-efficacy and satisfaction were relatively similar with scores above (3.17).

CIP Knowledge and Skills and age

- Teachers aged < 35 years of age had higher confidence than the other age groups.
- The difference in confidence between the 35 – 54 age group and > 54 age group was nonsignificant.
- The 35 – 54 years age group had a slightly higher level of self-efficacy to influence decision making than the < 35 years of age group.
- The < 54 years of age group scored the lowest across all ten scales.
- There was a noticeable difference between the < 35 years of age group and the > 54 years of age group across all scales.
- The < 35 age group recorded the highest level of burnout (2.57).

CIP Knowledge and Skills and frequency of using ICT

- Teachers spending > 30 hours per week using technology reported higher levels of confidence for all three scales in the CIP Knowledge Survey and all three scales in the CIP Skills Survey.
- Teachers spending > 30 hours per week using technology reported higher levels of self-efficacy to influence decision making and satisfaction with working with ICT than all other frequencies (< 11 hours; 11 – 20 hours; 21 – 30 hours).
- Teachers using technology 21 – 30 hours reported higher self-efficacy when using ICT and higher levels of burnout than all other frequencies (< 11 hours; 11 – 20 hours; > 30 hours)

The findings related to the differences between teachers' confidence, burnout, self-efficacy and satisfaction are discussed below in terms of the relationships between teacher confidence and: sex (Section 5.2.3.1); age (Section 5.2.3.2); and frequency of computer use (Section 5.2.3.3).

5.2.3.1 Teachers' Confidence is not related to sex.

Whilst females represented higher levels of confidence in ICT pedagogical knowledge and skills, the sex difference was very narrow suggesting that males and females had

similar levels of confidence. The low effect size supports this (0.04 to 0.01 standard deviations for CIP Knowledge; 0.07 to 0.15 standard deviations for CIP Skills). Furthermore, no significant difference between males and females was reported for burnout, self-efficacy (two scales), or satisfaction with working with ICT.

This finding is somewhat contradictory to that of Cai, Fan and Du (2017) and Jamieson-Proctor, Burnett, Finger and Watson (2006) who provide evidence that males have a more positive attitude towards technology than females. Similarly, Kay, (2006) and Wozney, Venkatesh and Abrami (2006) found that male teachers used technology more frequently than female teachers. Broos (2005) found that males have less computer anxiety than females. On the other hand, Yukselturk and Bulut (2009) found a reduction in the gender gap with more females accessing technology. Given that all of these studies are more than 10 years old, it is possible that the confidence difference for males and females have reduced. Therefore, it is recommended that future studies involve a larger sample to examine whether differences for male and female teachers is indeed improving. *(Recommendation #7)*

Given the results of my study, and the importance of factors related to confidence and self-efficacy, it is also recommended that teachers (both male and female) can improve their sense of self-efficacy to influence ICT decisions, express their views on ICT issues and resourcing. In addition, further research on teachers' self-beliefs in using technology to motivate students could be examined for both males and females. It is recommended that further research examine how teachers can improve their self-efficacy towards using technology *(Recommendation #8).*

5.2.3.2 Teachers' confidence is related to age.

This study revealed some age differences in levels of CIP Knowledge and CIP Skills, with teachers aged less than 35 years reporting the highest levels of both CIP Knowledge and CIP Skills. Teachers aged over 54 years reported the lowest levels of both CIP Knowledge and CIP Skills. The 35 to 54 years age group recorded slightly higher scores for both CIP Knowledge and Skills in terms of their self-efficacy to influence decision making, but the difference was nonsignificant. Albion, Jamieson-Proctor and Finger (2011) report few differences between age groups and levels of

ICT confidence. Whilst the effect sizes were low (<.2), the authors asserted that consideration should be given to the ICT confidence differences related to age. Other studies indicate inconsistencies in terms of teaching experience and confidence. For example, Lau and Sim (2008) found that older teachers were more likely to use technology and similarly Peralta and Costa (2007) found that teachers with more experience held greater ICT confidence. However, similar to the results reported in this thesis, Saltan and Arslan (2017) found that teachers with less experience reported higher levels of technological knowledge confidence.

Whilst reporting the highest levels of CIP knowledge and skills, and highest levels of self-efficacy and satisfaction, the less than 35 years of age group also scored the highest on the burnout scale. This pattern is worthy of examination in future research into the relationship between teachers' age with burnout and teachers' confidence in ICT pedagogy, self-efficacy and satisfaction with working with ICT is recommended *(Recommendation #9).*

5.2.3.3 Teachers' Confidence is related to hours of use.

Unsurprisingly, teachers using technology more frequently reported being more confident. Teachers using ICT for less than 11 hours per week reported the least amount of CIP knowledge and skills, whereas teachers using technology for 21 – 30 hours weekly reported the highest self-efficacy when using ICT and of burnout. This suggests that whilst this group of teachers feel that can *get through to the most difficult students, keep students on task, motivate students, and get students to work together* for example*,* they are also experiencing higher levels of *feeling emotionally drained, fatigued, burned out and frustrated.* It is recommended that further investigation be conducted to examine the relationship between frequency of ICT use and levels of burnout with teachers' confidence in ICT pedagogy, self-efficacy and satisfaction with working with ICT *(Recommendation #10).*

5.3 Limitations of the Study

The study presented in this thesis, like all studies, was not free of limitations. This section outlines some limitations in this research.

For the most part, the limitations of the study were related to the sample size, which was smaller than anticipated. Whilst 64% of the sample space schools agreed to participate in the study, 29% of the sample space teachers completed the surveys. The difficulties experienced in terms of encouraging teacher participation (which involved two separate administrations and expanding from only Catholic schools to including independent schools) resulted in a sample that was smaller than anticipated. It is recommended that future researchers consider administering surveys to teachers in ways that improve the response rate. For example, administering the survey on-line might have restricted participation due to the reliance on school assigned administrators who promoted the completion of the survey with varying degrees of success. It is recommended, therefore, that future studies include a paper version of surveys, along with a set time for administration, to increase response rates *(Recommendation #11).*

The scope of the sample was limited to teachers in schools from only two sectors in South Australia; Catholic and independent. Although including schools from other sectors was outside of the scope of the study, results should be generalised to schools in other sectors with caution. It is recommended, therefore, that future studies consider including teachers in the government sector and from different states in Australia in order to enhance generalizability (*Recommendation #12).*

Although, as an exploratory study, drawing on quantitative methods was appropriate, difficulties in explaining the results is acknowledged. To provide richer insights into the quantitative findings, it is recommended that future studies include qualitative information to help interpretation of findings (as recommended by Anderson & Arsenault, 2005, p.105) (*Recommendation #13*).

Changes in teachers' confidence over time were not tracked in this study. Although this was outside of the scope of the study, given the fast-paced changes involved in technology and that teachers' confidence in using technology changes over time, this information could have provided meaningful insights. It is recommended, therefore, that future studies involving teacher confidence when using ICT involve a longitudinal design (*Recommendation #14*).

The constructs that made up this study are, burnout, self-efficacy, satisfaction and confidence. It is reasonable to suggest that, of these, burnout is the weakest construct. It is recommended that future research relating to burnout and teachers' use of technology be undertaken. *(Recommendation #15)*

5.4 Summary of Recommendations

Recommendation #1	It is recommended that the CIP Knowledge and CIP Skills instruments used in this study be modified with a wider sample.
Recommendation #2	It is recommended that future studies using the BESS include measurements of ICT resources (personnel, professional and digital).
Recommendation #3	It is recommended that a future version of the BESS contain statements directly related to ICT use and burnout
Recommendation #4	It is recommended that schools adopt professional learning opportunities that support teachers' development of technology infused pedagogy that enhances current practice.
Recommendation #5	It is recommended that schools adopt opportunities for professional learning that engage teachers in successful mastery experiences with using ICT.
Recommendation #6	It is recommended that further research is conducted into the relationship between teachers' satisfaction and technology use.
Recommendation #7	It is recommended that future studies involve a larger sample to examine whether differences for male and female teachers is indeed improving.
Recommendation #8	It is recommended that further study should examine how teachers can improve their self-efficacy towards using technology.

Recommendation #9	It is recommended that future research examines the relationship between teachers' age with burnout and teachers' confidence in ICT pedagogy, self-efficacy and satisfaction with working with ICT.
Recommendation #10	It is recommended that further investigation be conducted to examine the relationship between frequency of ICT use and levels of burnout with teachers' confidence in ICT pedagogy, self-efficacy and satisfaction with working with ICT.
Recommendation #11	It is recommended that a paper version of surveys, along with a set time for administration, be used to increase response rates.
Recommendation #12	It is recommended that future studies consider including teachers in the government sector and from different states in Australia in order to enhance generalizability.
Recommendation #13	It is recommended that future studies include qualitative information to help interpretation of findings.
Recommendation #14	It is recommended that future studies involving teachers' confidence when using ICT involve a longitudinal design.
Recommendation #15	It is recommended that future research relating to burnout and teachers' use of technology be undertaken.

5.5 Significance of the Study

The motivation for this study came from observing teachers grapple with the ambiguities, potential and complexities of digital technologies that were rapidly replacing traditional classroom tools and practices. This study, therefore, is significant in the field of technology because it involved teachers' confidence as they used digital technologies to conduct their core business of teaching and learning.

A contribution of this study included the development and validation of two instruments to measure teachers' confidence in terms of their ICT pedagogical knowledge (CIP Knowledge Survey) and ICT pedagogical skills (CIP Skills Survey). Furthermore, the study involved the development and validation of an instrument to assess burnout, self-efficacy and satisfaction of teachers' using technology (BESS).

The findings indicated that teachers' self-efficacy and teachers' satisfaction were related to teachers' confidence in ICT pedagogical knowledge and ICT pedagogical skills. This result is in line with Lawrence and Tar's (2018) conceptual model of ICT adoption which highlights teacher attitude and belief as factors that influences ICT integration in the classroom. The research presented in this thesis adds to the literature on technology use by teachers as it demonstrates that, when teachers are confident in their ICT pedagogical knowledge and ICT pedagogical skills, their burnout is lower and their self-efficacy to use technology and satisfaction with working with technology are higher.

This study is firstly relevant to teachers because it has highlighted teachers' confidence towards technology as a significant contributor to using technology as a compulsory pedagogical tool in the classroom (Ertmer, 2005). Recognising that teachers' confidence in using ICT influences burnout, self-efficacy and satisfaction could assist teachers as they use technology to support learning, teaching and pedagogical practices in the classroom (Ertmer & Ottenbreit-Leftwich, 2010).

This study identified that teachers with high confidence in ICT pedagogical knowledge and ICT pedagogical skills are more likely to have high self-efficacy. Bandura's (1977) four-source theory of self-efficacy (physiological, persuasion, vicarious and mastery experiences) could be understood as a framework by which confidence in ICT pedagogical knowledge and pedagogical skills can be improved and in turn provide a lens by which professional learning related to ICT can be conducted. As teachers understand Bandura's four-source theory of self-efficacy, there is a chance that they will become aware of how to identify each source as being influenced by their confidence with using technology in the classroom. This study could benefit teachers who seek professional learning that incorporates Bandura's social cognitive theory as a learning framework to improve their self-efficacy.

Principals and school administrators might benefit from this study as it clearly demonstrates that teachers' confidence in ICT pedagogical knowledge and ICT pedagogical skills is related to both self-efficacy with technology and satisfaction with working with technology. Whilst the sample was limited to South Australia and results should be conveyed carefully, this study contributes to understanding how teachers' confidence towards ICT differs for teachers of different ages and sex. Results from this study could be used to influence professional learning opportunities by targeting groups to develop their confidence with using ICT. Professional learning and administrative support have been identified as ways to empower teachers to adopt pedagogical change that supports technology integration (Ertmer, Ottenbreit-Leftwich, & Tondeur, 2014). School administrators who implement professional learning that aims to improve confidence in ICT pedagogy are likely to see an improvement in teachers' self-efficacy and satisfaction with working with technology.

This thesis provides an examination of the relationship between teachers' technology confidence with burnout, self-efficacy and satisfaction. The study revealed a notable absence of literature related to ICT confidence and satisfaction. Therefore, this study has contributed to the dearth of research on teachers' satisfaction with ICT. Finally, this study is significant in providing three reliable and valid surveys to assess teachers' confidence with ICT and burnout, self-efficacy and satisfaction.

5.6 Final Remarks

Because digital technologies are complex tools for use in the classroom, mastering their use, is not like learning to ride a bicycle. Once the basic skills of balance and momentum are mastered, a bicycle rider can cycle for a life time. Rather, the digital technologies are more like the magical world of Hogwarts. Once you think you know the way to your next Potions class, the staircases suddenly change direction, the portraits go silent and another magic envelops the entire castle and causes disruption, uncertainty and confusion. Just as you learn to manage this new magic, along comes another spell, more sophisticated and exciting than the last. Digital technologies and devices are so diverse, unknown, innovative and, at times, unbelievable that it is hard to imagine how teachers can become digital technology wizards. And yet, digital

technology remains front and centre of educational institutions across the world, demanding we pay attention to its potential and place. Furthermore, teachers' use of technology must come as easily as any other educational tool. Teachers' satisfaction with ICT relies on high levels of confidence and self-efficacy as they use and work with technology. In order to meet the demands of being a teacher working in an ever-changing and ever-evolving digital world, improving teachers' confidence with ICT pedagogical knowledge and ICT pedagogical skills must be considered essential.

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APPENDIX A

Schools Data 2014

Structure, Location, ICSEA and Student Population for Each School.

Some data removed due to copyright. Can be found at www.myschool.edu.au

Schools data 2014										
School	**Catholic Schools**	**Year Levels**	**Coed/Single Sex**	**Geographical Location**	**Student population**	**ICSEA 2014**	**Total Teaching Staff**	**Response to Survey**	**Male**	**Female**
1	Cabra Dominican College	6 - 12	Co-ed	Metropolitan				10	3	7
2	Cardijn College	8 - 12	Co-ed	Metropolitan				49	17	32
3	Caritas College	R - 12	Co-ed	Regional				8	1	7
4	Mary MacKillop College	8 - 12	Girls	Metropolitan				23	3	20
5	Kildare College	8 - 12	Girls	Metropolitan				1		1
6	Sacred Heart College Middle School	6 - 9	Boys	Metropolitan				10	5	5
7	St. Aloysius College	R - 12	Girls	City				13		13
8	OLSH College	8 – 12	Girls	Metropolitan				1		1
9	St. Mark's College	R - 12	Co-ed	Regional				13	4	9
10	St. Mary's College	R – 12	Girls	City				16	4	12
11	St Paul's College	R - 12	Boys	Metropolitan				5	4	1
12	St Peters Collegiate	R - 12	Girls	Metropolitan				4	1	3
13	Woodcroft College	R - 12	Co-ed	Metropolitan				7	4	3
14	University Senior College	11- 12	Co-ed	City				3	1	2

www.myschool.edu.au

APPENDIX B

Breakdown of the distribution of the teacher sample in terms of sex, age and years of teaching.

Sample Distribution of Male and Female from 14 Schools

	Teacher Sex		
School	**Male**	**Female**	**Total**
1	3	7	10
2	17	32	49
3	1	7	8
4	3	20	23
5	0	1	1
6	5	5	10
7	0	13	13
8	0	1	1
9	4	9	13
10	4	12	16
11	4	1	5
12	1	3	4
13	4	3	7
14	1	2	3
Total	**47**	**116**	**163**

Sample Distribution of Schools and Age (A) of Teacher.

	Age of Teacher						
School	**A1**	**A2**	**A3**	**A4**	**A5**	**A6**	**Total**
1		1	2	2	4	1	10
2	2	17	13	10	7		49
3	1	3	1	3			8
4	1	6	3	5	5	3	23
5				1			1
6		1	2	4	3		10
7		2	2	6	1	2	13
8			1				1
9		3	2	2	5	1	13
10		6	4	4	2		16
11		1	1	2	1		5
12				3	1		4
13		3	1	1	2		7
14		0	1	1	1		3
Total	**4**	**43**	**33**	**44**	**32**	**7**	**163**

A1=18-24 years of age.

A2=25-34 years of age.

A3=35-44 years of age.

A4=45-54 years of age.

A5 = 55-64 years of age.

A6= 65-74 years of age.

Sample Distribution of Schools and Years of Teaching (YT).

	Years of Teaching				
School	**YT1**	**YT2**	**YT3**	**YT4**	**Total**
1		1	3	6	10
2	5	20	17	7	49
3	1	4	3		8
4		7	9	7	23
5			1		1
6		1	6	3	10
7	1		11	1	13
8			1		1
9	1	4	5	3	13
10	2	4	8	2	16
11		1	1	3	5
12		1	1	2	4
13	2	1	2	2	7
14		2		1	3
Total	**12**	**46**	**68**	**37**	**163**

YT1 = Pre-service-5 years.

YT2 = 4-10 years.

YT3 = 11-30 years.

YT4 = 31 & more years.

APPENDIX C

Original TPACK Survey and Permission to use.

Jamieson-Proctor, R., Albion, P., Finger, G., Cavanagh, R., Fitzgerald, R., Bond, T., & Grimbeek, P. (2013). Development of the TTF TPACK survey instrument. *Australian Educational Computing, 27*(3), 26-35.

The TPK/TCK Original Items

Confidence and Usefulness

How confident are you that you have the knowledge, skills and abilities to support students' use of ICT to…?

How useful do you consider it will be for you, as a teacher, to ensure your students use ICT to…

1. demonstrate knowledge of a range of ICT to engage students
2. use ICT and teaching strategies that are responsive to students' diverse backgrounds
3. use ICT and teaching strategies that are responsive to students' learning styles
4. use ICT and teaching strategies to support students from Aboriginal and Torres Strait Islander backgrounds. *Excluded*
5. use ICT and teaching strategies to personalise learning activities for students
6. use ICT to access, record, manage, and analyse student assessment data. *Excluded*
7. use ICT to teach specific subject areas in creative ways
8. design learning sequences, lesson plans and assessments that incorporate ICT use by students
9. select and organise digital content and resources
10. use ICT for reporting purposes, such as reporting to parents/carers
11. demonstrate how ICT can be used to support literacy learning
12. demonstrate how ICT can be used to support numeracy learning
13. design ICT activities that enable students to become active participants in their own learning
14. select and use a variety of digital media and formats to communicate information
15. engage parents and families in their child's schooling through ICT
16. manage challenging student behaviour by encouraging the responsible use of ICT. *Excluded*
17. be aware of digital citizenship to promote student demonstration of rights and responsibilities in using digital resources and tools
18. identify personal and professional learning goals in relation to using ICT
19. reflect on relevant ICT research to inform professional practice
20. use a range of ICT resources and devices for professional purposes. *Excluded*
21. use ICT to engage with colleagues to improve professional practice
22. use ICT to collaborate for professional purposes, such as online professional communities
23. evaluate how ICT use has helped to achieve specific subject area goals
24. demonstrate an understanding of safe, legal and ethical use of digital information and technologies

Hi Helen

Yes I developed the original instrument that the TPACK Confidence Survey was later created from. I am happy for you to use the instrument as long as it is referenced appropriately. The TTF project publications all carry the following acknowledgement:
The Teaching Teachers for the Future (TTF) Project is funded by the Australian Government Department of Education, Employment and Workplace Relations (DEEWR) through the ICT Innovation Fund.

Regards
Romina

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The TPK/TCK Original Items Confidence and Usefulness as published in:

Jamieson-Proctor, R., Albion, P., Finger, G., Cavanagh, R., Fitzgerald, R., Bond, T., & Grimbeek, P. (2013). Development of the TTF TPACK survey instrument. *Australian Educational Computing, 27*(3), 26-35.

I hereby give permission for **Helen Steele** to include the abovementioned material(s) in his/her higher degree thesis for Curtin University, and to communicate this material via the espace institutional repository. This permission is granted on a non-exclusive basis and for an indefinite period.

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The Teaching Teachers for the Future (TTF) Project was funded by the Australian Government Department of Education, Employment and Workplace Relations (DEEWR) through the ICT Innovation Fund.

Signed: 

Name: Romina Jamieson-Proctor

Position: Professor of Education, ACU

Date: 16 February 2020

APPENDIX D

Confidence in ICT Pedagogical (CIP) Knowledge Survey and the Confidence in ICT (CIP) Pedagogical Skills Survey and the Burnout, Self-efficacy and Satisfaction Survey (BESS).

Developed by Steele, H (2014)

Teacher confidence with Information Communication Technologies. (ICT)

Introduction

The use of Information Communication Technologies (ICT) in the classroom has become an integral way in which students learn and teachers teach. The rapid growth of this industry has caused an avalanche of programs, applications, resources and ideas that impact how educators prepare for, present and evaluate their teaching.

This questionnaire has been designed to gain an understanding of how teachers perceive their confidence, self- efficacy, satisfaction and burnout as a consequence of using Information Communication Technologies.

*1. What is the name of your school?

*2. Are you male or female?

- Male
- Female

*3. What is your age?

- 18 to 24
- 25 to 34
- 35 to 44
- 45 to 54
- 55 to 64
- 65 to 74
- 75 or older

*4. How many years have you been teaching?

- Pre-service Teacher
- 0-3 Years
- 4-10 Years
- 11-20 Years
- 21-30 Years
- 31 - 40 Years
- More than 41 Years

Teacher confidence with Information Communication Technologies. (ICT)

Qualifications

5. What is the level of the highest qualification you have completed in the field of Education. Please click one box only.

- ○ Doctoral Degree
- ○ Masters Degree
- ○ Bachelor (Honours) Degree
- ○ Graduate Diploma
- ○ Graduate Certificate
- ○ Bachelor Degree
- ○ Diploma or Advanced Diploma

6. What is the level of the highest qualification you have completed in a field other than Education?

- ○ Doctoral Degree
- ○ Masters Degree
- ○ Graduate Diploma
- ○ Graduate Certificate
- ○ Bachelor (Honours) Degree
- ○ Bachelor Degree
- ○ Diploma or Advanced Diploma
- ○ Certificate III/IV
- ○ Certificate I/II

Teacher confidence with Information Communication Technologies. (ICT)

Your Current Position

7. Which of the following best characterises your position in the school?

- Mainly classroom teaching
- Mainly managing an area or department in the school
- Mainly providing specialist support to students
- A combination of classroom teaching and management

8. In a typical week how many hours do you spend using Information Communication technologies for school work purposes?

- Less than 5 hours
- 5 - 10 hours
- 11 - 20 hours
- 21 - 30 hours
- 41 - 50 hours
- More than 50 hours

Teacher confidence with Information Communication Technologies. (ICT

Teacher Confidence

The teacher confidence section of this survey aims to measure the confidence you have in your KNOWLEDGE and SKILLS when using ICT.

The statements are repeated for each of the two concepts beginning with ICT KNOWLEDGE.

Teacher confidence with Information Communication Technologies. (ICT)

CONFIDENCE IN MY ICT KNOWLEDGE.

9. Teaching knowledge.

Rate your confidence in your ICT KNOWLEDGE when using it to:

	No confidence	Little confidence	Moderate confidence	A lot of confidence	Full confidence	Unable to Judge
Respond to student's diverse backgrounds.						
Respond to student's learning styles.						
Personalise learning activities for students.						
Teach specific subjects in creative ways.						
Design activities that engage students.						

10. Organisational knowledge.

Rate your confidence in your ICT KNOWLEDGE when using it to:

	No confidence	Little confidence	Moderate confidence	A lot of confidence	Full confidence	Unable to Judge
Manage student data.						
Select digital content						
Communicate with colleagues.						
Engage with colleagues to improve professional practice.						
Collaborate with colleagues for professional purposes.						
Communicate with parents.						

Teacher confidence with Information Communication Technologies. (ICT)

11. Wider Community knowledge.

Rate your confidence in your ICT KNOWLEDGE when using it to:

	No confidence	Little confidence	Moderate confidence	A lot of confidence	Full confidence	Unable to Judge
Promote student rights and responsibilities when using digital resources.	○	○	○	○	○	○
Engage parents and families in their child's schooling.	○	○	○	○	○	○
Promote student awareness of digital citizenship.	○	○	○	○	○	○
Promote student understanding of safe use of digital information.	○	○	○	○	○	○

Teacher confidence with Information Communication Technologies. (ICT)

CONFIDENCE IN MY ICT SKILLS.

12. Teaching skills.

Rate you confidence in your ICT SKILLS when using it to:

	No confidence	Little confidence	Moderate confidence	A lot of confidence	Full confidence	Unable to Judge
Respond to student's diverse backgrounds.						
Respond to student's learning styles.						
Personalise learning activities for students.						
Teach specific subjects in creative ways.						
Design activities that engage students.						

13. Organisational skills.

Rate your confidence in your ICT SKILLS when using it to:

	No confidence	Little confidence	Moderate confidence	A lot of confidence	Full confidence	Unable to Judge
Manage student data.						
Select digital content						
Communicate with colleagues.						
Engage with colleagues to improve professional practice.						
Collaborate with colleagues for professional purposes.						
Communicate with parents.						

Teacher confidence with Information Communication Technologies. (ICT)

14. Wider communityskills.

Rate your confidence in your ICT SKILLS when using it to:

	No confidence	Little confidence	Moderate confidence	A lot of confidence	Full confidence	Unable to Judge
Promote student rights and responsibilities when using digital resources.	◯	◯	◯	◯	◯	◯
Engage parents and families in their child's schooling.	◯	◯	◯	◯	◯	◯
Promote student awareness of digital citizenship.	◯	◯	◯	◯	◯	◯
Promote student understanding of safe use of digital information.	◯	◯	◯	◯	◯	◯

Teacher confidence with Information Communication Technologies. (ICT)

Teacher Self-Beliefs and Satisfaction

For each statement below, rate the effect that you have on this aspect of your work.

15. Influence Decision Making at My School.

	Not at all	Very little	Somewhat	Quite a bit	A great deal
I can influence decisions that are made about ICT.	○	○	○	○	○
I can express my views on ICT matters.	○	○	○	○	○
I have access to ICT resources.	○	○	○	○	○

16. Instructional Self-Belief.

When using ICT, I can ...

	Not at all	Very little	Somewhat	Quite a bit	A great deal
Get through to the most difficult students.	○	○	○	○	○
Promote learning with ICT when there is lack of support from the home.	○	○	○	○	○
Keep students on task.	○	○	○	○	○
Increase students' memory of what has been taught previously.	○	○	○	○	○
Motivate students.	○	○	○	○	○
Get students to work together.	○	○	○	○	○
Get students to do their homework.	○	○	○	○	○

17. Teacher Work Satisfaction.

At my school...

	Not at all	Very little	Somewhat	Quite a lot	A great deal
I enjoy working with ICT.	○	○	○	○	○
I enjoy teaching with ICT.	○	○	○	○	○
Working with ICT is personally satisfying.	○	○	○	○	○
I enjoy the challenge of working with ICT.	○	○	○	○	○
I would like to continue working with ICT.	○	○	○	○	○
Using ICT how much can you do to get students to believe they can do well in schoolwork?	○	○	○	○	○

Teacher confidence with Information Communication Technologies. (ICT)

Teacher Burnout

This part of the survey is based on the Maslasch Burnout Inventory (MBI).

Please read each statement carefully and choose the response that most expresses how you feel about being a teacher.

18. Teacher Burnout

	Not at all	Very little	Somewhat	Quite a lot	A great deal
I feel emotionally drained at school.					
I feel fatigued when I get up in the morning and have to face another day at school.					
I feel burned out from my work.					
I worry that teaching is hardening me emotionally.					
I don't really care what happens with some students.					
I feel students blame me for their learning problems.					
I feel frustrated in my work.					
I feel I am working too hard at school.					
I can easily create a relaxed atmosphere at school.					
In my work I deal with problems very calmly.					

APPENDIX E

The Maslach Burnout Inventory – Permission to Use

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To Whom It May Concern,

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Sample Items:

MBI - Human Services Survey - MBI-HSS:
I feel emotionally drained from my work.
I have accomplished many worthwhile things in this job.
I don't really care what happens to some recipients.

For use by Helen Steele only. Received from Mind Garden, Inc. on May 15, 2019

Sincerely,

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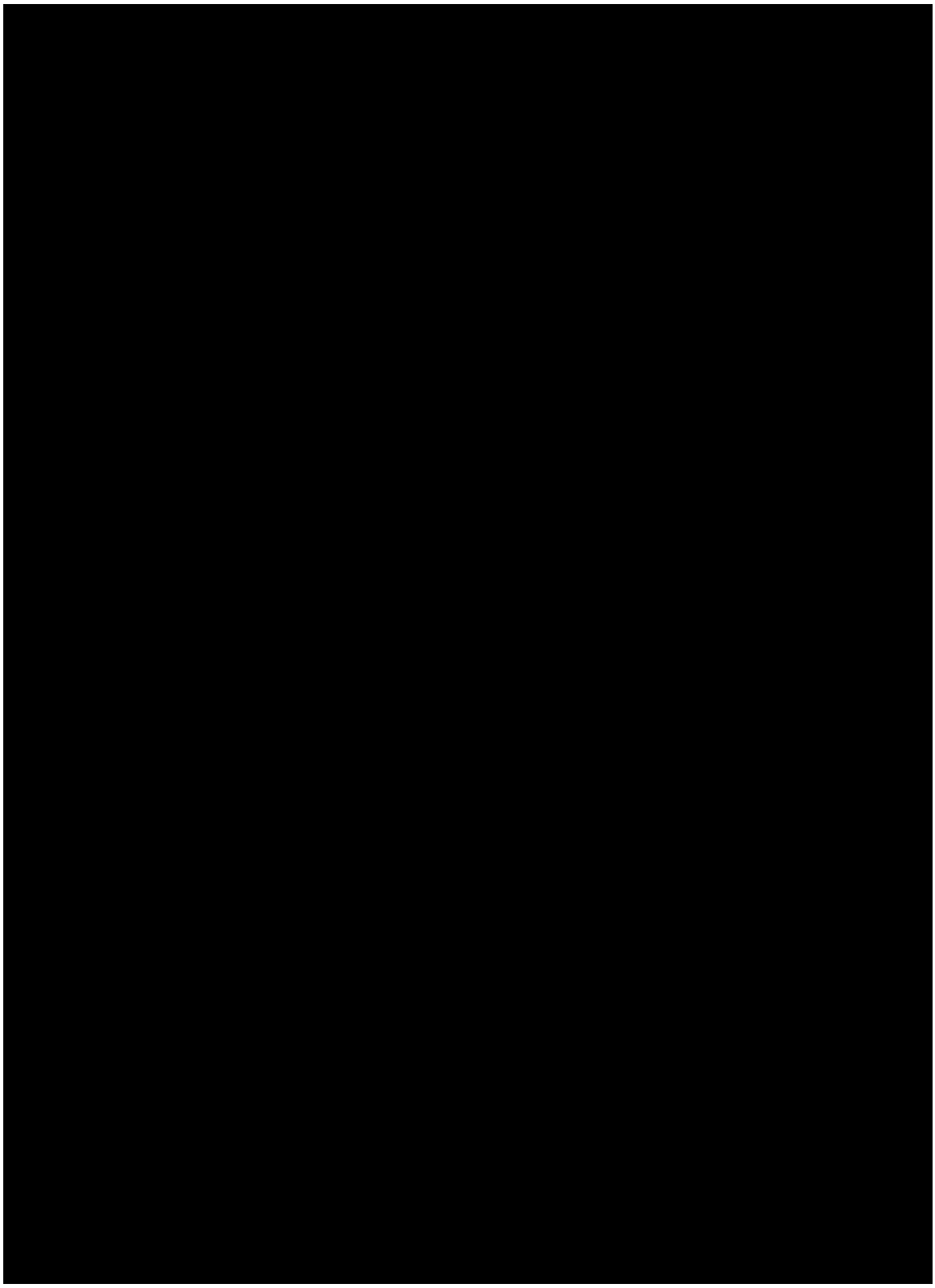
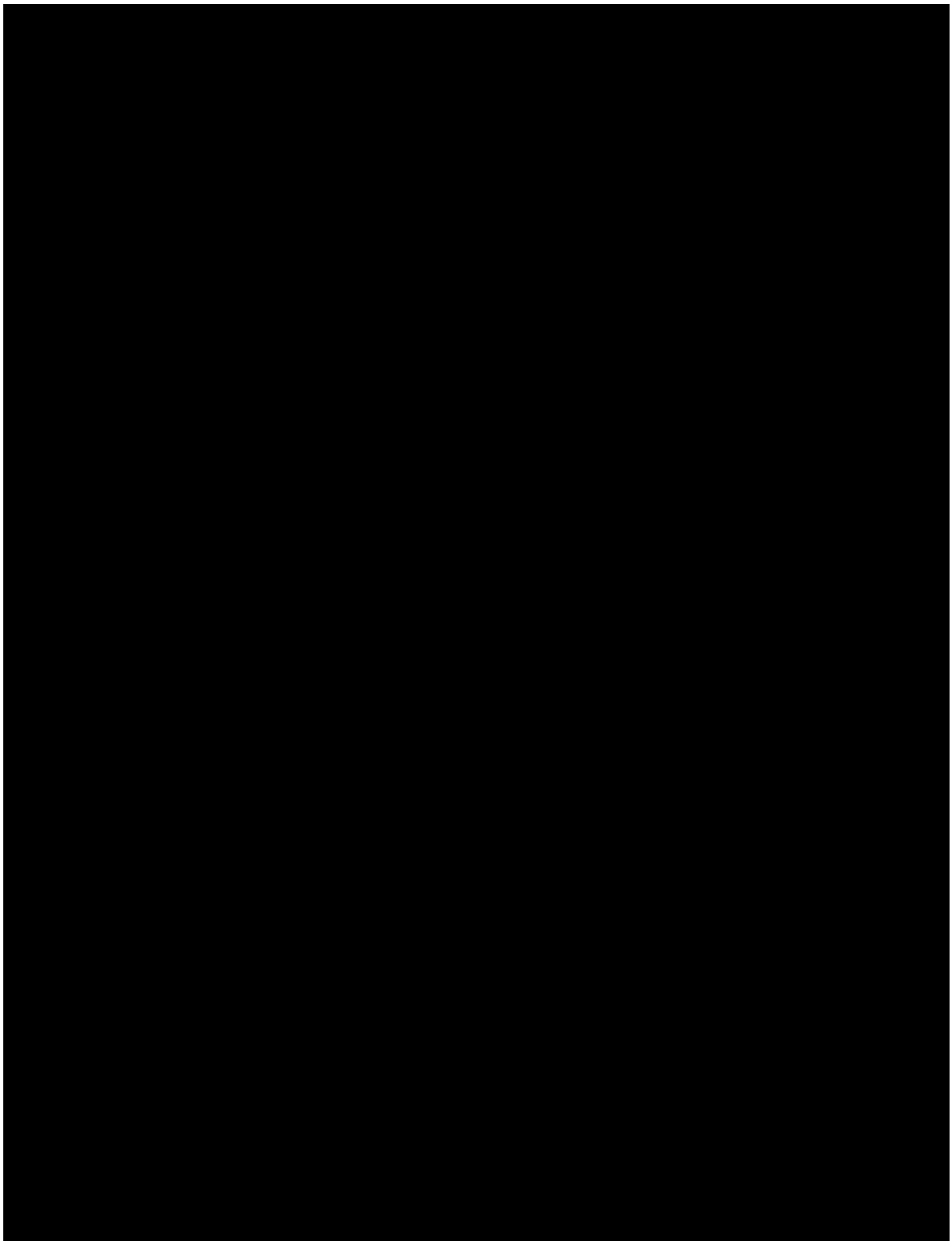
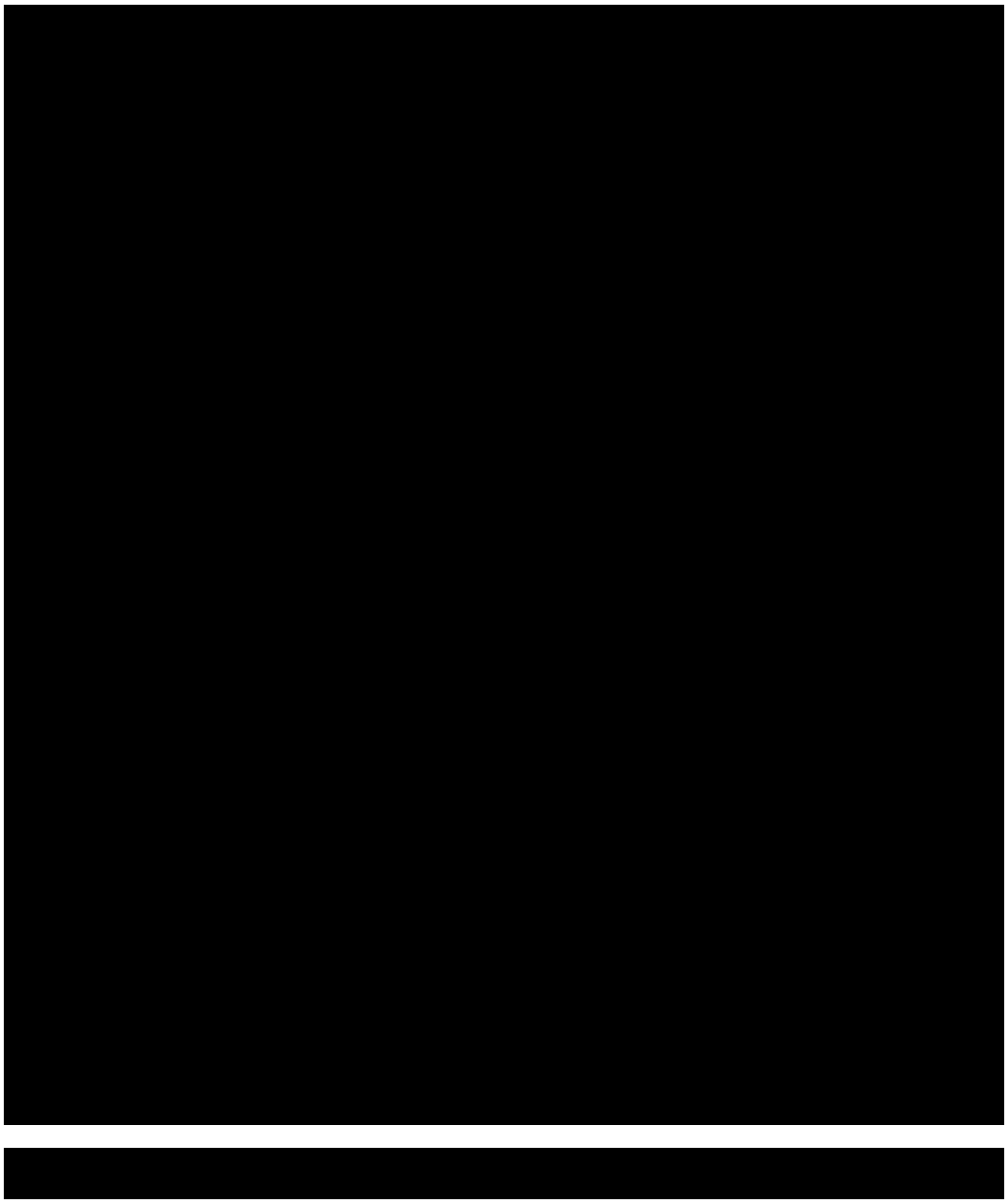
APPENDIX F

Bandura's Instrument Teacher Self-Efficacy Scale

Removed due to copyright. Can be available at http://www.till.org.uk/wp-content/uploads/2019/03/Bandura-Instr-1sdm5sg.pdf







APPENDIX G

Teacher Work Satisfaction Scale

Teacher Work Satisfaction Permission to modify granted by Dr Jill Aldridge.

	Actual				
Teacher Work Satisfaction	**Almost Never**	**Seldom**	**Sometimes**	**Often**	**Almost Always**
1. I enjoy working at this school.					
2. Working at this school is personally satisfying.					
3. Working at this school is professionally satisfying.					
4. I enjoy the challenges at this school.					
5. I want to continue working at this school.					
6. The atmosphere at this school makes my work enjoyable.					
7. I feel that I am moving forward professionally at this school.					
8. I am pleased that I chose to work at this school.					

Aldridge, J. M., & Fraser, B. J. (2016). Teachers' views of their school climate and its relationship with teacher self-efficacy and job satisfaction. *Learning Environments Research, 19*(2), 291-307.

APPENDIX H

Pilot Study Feedback Sheet

Pilot Study Feedback Sheet

Thank you for participating in the pilot study for my research on teachers' confidence in using digital devices with students on teacher self-efficacy, teacher satisfaction and teacher burnout.
Please take a few moments to answer the following questions.

1. Did you find the survey easy to navigate? Do you have any suggestions for improvement?

2. Did the response format follow a logical path from the stems and the items?

3. Did the response options provide enough choice for you as a participant?

4. Are the instructions easy to follow?

5. Are the terms confidence, burnout, self-efficacy and satisfaction understood for the context of the study?

6. Were the items easy to understand?

7. What suggestions do you have to improve the survey?

APPENDIX I

Supervisor Script

Dear

Thank you so much for being the contact person for administering my survey – '***Investigating the relationship between teachers' confidence in using digital devices with students on their self-efficacy, teacher satisfaction and teacher burnout.'***

I have attached an outline of my study – Information Sheet – which includes a Consent Form along with the Administration document.

The survey can be completed at this link. https://www.surveymonkey.com/s/VM583WY-MMC

The survey will take about 15 minutes to complete.

Please provide a copy of the Consent Form to your teaching staff that they fill in on completion of the survey.

Once you have made a formal request from your teaching staff to complete the survey, my suggestion is that you copy the following wording into a group email to the teachers.

> Dear Teaching Staff
> Thank you for agreeing to partake in the research on '***Investigating the relationship between teachers' confidence in using digital devices with students on their self-efficacy, teacher satisfaction and teacher burnout.'***
>
> The survey should take approximately 15 minutes and can be completed at this link. https://www.surveymonkey.com/s/VM583WY-MMC
>
> Please also complete the Consent Form that is at the end of the attached Information Sheet and return to me. The survey is anonymous other than our school name. The school will not be identified in any publication. Participants are free to withdraw from the survey at any time.
>
> I thank you on behalf of the researcher, Helen Steele, for your contribution to her research.
>
> [Your name]

As indicated in the Questionnaire Administration document attached I would be most grateful if the surveys could be completed by Friday 25 July.

My sincerest thanks for your support

Helen

APPENDIX J

Survey Administration Instructions

The following aims to outline the procedures for successfully administering the questionnaire:

Teacher Confidence with Information Communication Technologies

Introduction

The use of Information Communication Technologies (ICT) in the classroom has become an integral way in which students learn and teachers teach. The rapid growth of this industry has caused an avalanche of programs, applications, resources and ideas that impact how educators prepare for, present and evaluates their teaching. This questionnaire has been designed to gain an understanding of how teachers perceive their confidence, self-efficacy, satisfaction and burnout as a consequence of using Information Communication Technologies. A link to the online questionnaire will be emailed to teachers.

Supervisors Role

The Questionnaire Supervisors role is to serve as a point of contact between me and the teachers taking part in the survey. The survey should take about 20 minutes to complete. The supervisor is asked to do the following:

- Make a formal request of teachers to complete the survey.
- Forward the link for the survey to all teaching staff via email.
- Select a common time for the survey to be completed by for your staff.

After the survey

Please email me once your teaching staff members have completed the survey.

Contact Details

Name: Helen Steele

Mobile Number: 0408108496

Work Phone Number: 83336300

Email: hbtsteele@gmail.com

Work email: hsteele@marymackillop.sa.edu.au

APPENDIX K

Participant Information Sheet

Information Sheet- Principals and Teachers

Project Title
Investigating the relationship between teachers' confidence in using digital devices with students on their self-efficacy, teacher satisfaction and teacher burnout

Principal Researcher
My name is Helen Steele and I am studying at Curtin University, Perth as an external Doctorate Student. I aim to complete my research on the above mentioned project title.

Purpose of the Research
The rapid development of the digital device in the classroom has caused an avalanche of programs, applications, resources and ideas that impacts teaching. This research will examine whether the level of a teachers' confidence with digital devices is related to self-efficacy, satisfaction and burnout.

Research Approach
This study is a quantitative study that includes teachers completing a four part survey. The objective of the surveys will be to seek an understanding of the professional and personal impact on teachers as they engage with digital devices in the classroom. The survey will include four sections: Teacher Confidence, Teacher Self-Efficacy, Teacher Satisfaction, and Teacher Burnout. The survey is expected to take 15-20 minutes to complete

Participation
This research requires the support of 20 schools. Permission is sought from principals in the first instance followed by seeking permission from the relevant governing bodies. Teachers' permission will then be sought. Surveys will be distributed to consenting teacher via email. There are no benefits or risks associated with participation and participants are free to withdraw if the need arises.

Anonymity
The participants and schools of the study will remain anonymous and numerical codes will be allocated to each survey. Principals will be given a summary of their schools data.

Storage and Future Use of Data
During analysis, all data will be stored on a password protected computer located in my home. All work will be backed up to a portable hard drive which will be stored in a locked filing cabinet. The data will be protected by passwords and any printed data will be held in a locked filing cabinet in my home office. The data will be accessed only by me and shared with my supervisor. After the thesis has been published, data in my home office will be destroyed. All copies of the data will be stored in a safe and secure location in the Department of Mathematics and Science at Curtin University for a period of five years.

Results
The results of the surveys will be published as part of the final thesis. Furthermore, results are likely to be used as part of presentations on the topic at conferences and published in academic journals

Questions and or Complaints
If you have questions regarding this study please contact the researcher; Helen Steele, hbtsteele@gmail.com

Should you wish to make a complaint on ethical grounds please contact the Human Research Ethics Committee (phone 92662784 or hrec@curtin.edu.au or in writing C/- Office of Research and development, Curtin University of Technology, GPO Box U1987, Perth, WA 6845

Research Approval
This study has been approved by Curtin University SMEC – 29 - 13

Consent Form

Investigating the relationship between teachers' confidence in using digital devices with students on their self-efficacy, teacher satisfaction and teacher burnout

Principal Researcher: Helen Steele

I have been informed of and understand the purposes of the study.

I have been given an opportunity to ask questions.

I understand I can withdraw at any time without prejudice.

Any information which might potentially identify me will not be used in published material.

I agree to participate in the study as outlined to me.

Name of Participant: _____

Signature: _____

Date: _____

APPENDIX L

Email to be sent to teaching staff by the school supervisor.

Dear Teaching Staff

Thank you for agreeing to partake in the research on '***Investigating the relationship between teachers' confidence in using digital devices with students on their self-efficacy, teacher satisfaction and teacher burnout.'***

The survey should take approximately 15 minutes and can be completed at this link. https://www.surveymonkey.com/s/VM583WY-MMC

Please also complete the Consent Form that is at the end of the attached Information Sheet and return to me. The survey is anonymous other than our school name. The school will not be identified in any publication. Participants are free to withdraw from the survey at any time.

I thank you on behalf of the researcher, Helen Steele, for your contribution to her research.

[Your name]

APPENDIX M

Copy of Researchers' Ethics Approval from Curtin University

Curtin University

Memorandum

To	Helen Steele, SMEC
From	Pauline Howat, Administrator, Human Research Ethics Science and Mathematics Education Centre
Subject	Protocol Approval SMEC-29-13
Date	7 November 2013
Copy	Jill Aldridge, SMEC

Office of Research and Development

Human Research Ethics Committee

Telephone 9266 2784
Facsimile 9266 3793
Email hrec@curtin.edu.au

Thank you for your "Form C Application for Approval of Research with Low Risk (Ethical Requirements)" for the project titled "Investigating the relationship between teachers' confidence in using digital devices with students on their self-efficacy, teacher satisfaction and teacher burnout". On behalf of the Human Research Ethics Committee, I am authorised to inform you that the project is approved.

Approval of this project is for a period of 4 years 7th November 2013 to 6th November 2017.

Your approval has the following conditions:

(i) Annual progress reports on the project must be submitted to the Ethics Office.

(ii) It is your responsibility, as the researcher, to meet the conditions outlined above and to retain the necessary records demonstrating that these have been completed.

The approval number for your project is SMEC-29-13. Please quote this number in any future correspondence. If at any time during the approval term changes/amendments occur, or if a serious or unexpected adverse event occurs, please advise me immediately.

Pauline

PAULINE HOWAT
Administrator
Human Research Ethics
Science and Mathematics Education Centre

Please Note: The following standard statement must be included in the information sheet to participants:
This study has been approved under Curtin University ٢s process for lower-risk Studies (Approval Number xxxx). This process complies with the National Statement on Ethical Conduct in Human Research (Chapter 5.1.7 and Chapters 51.18-5.1.21). For further information on this study contact the researchers named above or the Curtin University Human Research Ethics Committee, c/- Office of Research and Development, Curtin University, GPO Box U1987, Perth 6845 or by telephoning 9266 9223 or by emailing hrec@curtin.edu.au.

APPENDIX N

Approval from Director of Catholic Education South Australia.

Catholic Education Centre
1 16 George Street Thebarton SA 5031
PO Box 179 Torrensville Plaza South Australia 5031 Telephone: (08) 8301 6600
Facsimile: (08) 8301 6611
ISD: 61 8 8301 6600
Catholic Education Email: director@cesa.catholic.edu.au S O U T H A U S T R A L I A
www.cesa.catholic.edu.au

Ms Helen Steele

Deputy Principal

Mary MacKillop College

Po Box 4034

NORWOOD SOUTH SA 5067

Dear Helen

Thank you for your email of 28 February 2014 in which you seek permission to investigate the relationship between teachers' confidence in using digital devices with students on their self-efficacy, teacher satisfaction and teacher burnout. I understand that you will be asking teachers who chose to be involved in the project to complete a four-part survey.

In the normal course, permission of the Principal of each school in which you wish to conduct research is required. Research in Catholic schools is granted on the basis that individual students, schools and the Catholic sector itself is not specifically identified in published research data and conclusions.

Approval is also contingent upon the following conditions, i.e. that:

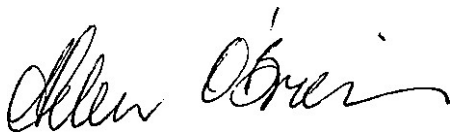
- a copy of the questionnaire has been provided to the Principal
- the permission of the teachers has been obtained
- the research complies with the ethics proposal of Curtain University.

- the research complies with any provisions under the Privacy Act that may require adherence by you as researcher in gathering and reporting data . no comparison between schooling sectors is made
- the researcher will be carrying out the research within view of the class teacher or authorised school observer
- sector requirements relating to child protection and police checks are met by researchers:
- where researchers obtain information in relation to a student which suggests or indicates abuse, this information must be immediately conveyed to the Director of Catholic Education SA
- all researchers and assistants, who in the course of the research interact in any way with students, are required to provide evidence of an acceptable police clearance direct to the school.

As you indicate that the research will not involve direct contact with students, a police check will not be necessary in this instance. Should this change, you are required to immediately notify this Office and obtain a National Police Certificate prior to any involvement with students. A clearance letter from the Archdiocesan Police Check Unit must be made available to the Principal.

Please accept my very best wishes for the research process.

Yours sincerely



HELEN O'BRIEN

DEPUTY DIRECTOR

13 March 2014