Teachers’ Perceptions of Factors Affecting the Successful Teaching of ICT

by

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BIS, BCom (Hon)

Submitted in fulfilment of the requirements for the degree of

Doctor of Philosophy

Deakin University
February 2017
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Acknowledgements

This thesis is dedicated to all those who believed in me, even before I believed in myself, to list them all would take a PhD. If it were not for the encouragement from so many, I would never have persisted. Prior to starting the PhD journey, I asked many for their opinion and received comments on the grounds of “Go for it, Girl.” Even with this level of encouragement, I still felt unfit for the task. Completion came as a huge surprise, with the path extremely long, arduous, time-consuming, and enduring multiple interruptions. On at least two occasions, I wanted to quit. I still think that I was crazy to undertake such a pilgrimage.

The first and probably the most important to thank are my supervisors (and mentors), Annemieke and Jo, whose duty it was to guide and encourage me. I cannot say how many times I felt lost and confused and became off track. They gently, although, with a very firm hand, guided me back on.

Equally important, I wish to thank my children, Rorie, Kathleen and Aimee-Lauren, who, over the years, have had to adjust to schedule changes, undone housework, quick meals, and rushed mornings. I also acknowledge other family members and all of our beloved pets, among whom, Anastasia and Midnight’s prized company endured most of the path, but sadly did not make it to the end.

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You may ask, well what have I learnt on this adventure. To start with there is diligence and perseverance, multitasking, working independently, problem-solving, skill sharing, and honing research skills. Accompanied closely behind these are time management, staying on task, and the fine art of procrastination. Am I any smarter for undertaking this journey? Only time will tell? A mirror above my desk at home notes:

“I don’t know what I’m doing, but I’m an expert at it.”
Poem

Be not afraid
Do not dwell in the past
Yesterday is only a memory
Concentrate on the present
Experience mind moments today
Think, learn, grow, and practice
Find truth, power, and wisdom
Tomorrow is but today’s dream
Experience the now
But
Dream of the future

Christine McLachlan 2014
Publications During this Research


Presentations During this Research

Abstract

Educational policy changes introduced in the 1980s altered how schools in Australia operated, giving them autonomy over their governance and, together with subsequent curriculum frameworks, choice as to how they delivered subjects to students. Consequently, the discipline area of ICT became components of other learning areas in many schools. In the last ten years, national and state governments have contributed significant investments into ICT education, however, students’ ICT Literacy has not improved and fewer students elect to study ICT in the post-compulsory and tertiary years.

In 2017, the ratio of digital devices to students is 1:1 in most secondary schools in Australia. Successful teaching with digital devices demands that teachers possess skills that are transferable across devices to meet the needs of the curriculum, the schools and their students. This research investigates schoolteachers perceptions of ICT education by exploring the research question ‘How can teachers improve the factors affecting the successful teaching of ICT in schools?’ through a grounded theory study. The study incorporated sequential mixed methods in a two-phased project.

The first phase consisted of ten semi-structured interviews conducted with ICT teachers in Victorian secondary schools. The interviews collected qualitative data through specifically developed open-ended questions that were analysed using open and selective grounded theory coding. The interviewed teachers, chosen through purposive and theoretical sampling, all had a high level of ICT knowledge. The two prominent areas of teachers’ ICT skills and ICT professional development emerged and formed the basis of investigation in the second phase.

The second phase incorporated survey research, through an online questionnaire. The questionnaire consisted of forty questions in five sections and combined open-ended and closed-ended questions collecting both quantitative and qualitative data. The questions, developed from the first phase and literature investigations, related to the respondents’ school, their computing skills, past training experiences, future training wishes, and themselves. The questionnaire items had good internal consistency. The variable types and number of responses limited the data analysis to descriptive methods. Qualitative responses were
thematically analysed. The second phase formed selective and theoretical coding processes of grounded theory.

The coding processes in Phase 1 resulted in a tentative substantive model titled ‘The Tangled Web of ICT Education’. This consisted of condensed categories with ICT teachers at the centre, and ICT education, ICT education delivery, student learning with ICTs, teaching with ICTs, and ICT teacher support making up the five points of the web. Each point interconnects to each other point. Additionally, the minor issues of non-school issues, school differences, ICT tools, and policies and infrastructure are on the outskirts of the web, although remaining within the ICT education realm.

Phase 2 expanded the Phase 1 model. The project culminated with a substantive general theory that incorporated teachers’ skills development. The project concluded that there are teachers who still lack necessary ICT skills, teachers cannot access appropriate ICT professional development, no one form of professional development meets all teachers’ ICT needs, and although governments and some schools provide support for ICT and ICT in education, the support does not seem to reach those that need it most.
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## Glossary of Acronyms

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<td>CA</td>
<td>Computer Awareness</td>
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<td>CS</td>
<td>Computer Science</td>
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<td>CSF</td>
<td>Curriculum and Standards Framework</td>
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<td>CSFII</td>
<td>Curriculum and Standards Framework II</td>
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<td>CTFS</td>
<td>Computer Technologies for Schools</td>
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<tr>
<td>DER</td>
<td>Digital Education Revolution</td>
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<td>eduSTAR</td>
<td>School Technology Architecture and Resources</td>
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<td>eduSTAR.NTP</td>
<td>Notebooks for Teachers and Principals Program</td>
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<tr>
<td>HSC</td>
<td>Higher School Certificate</td>
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<tr>
<td>ICILS</td>
<td>International Computer and Information Literacy Study</td>
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<td>ICT</td>
<td>Information and Communications Technology</td>
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<td>ICTIF</td>
<td>ICT Innovation Fund</td>
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<td>IPM</td>
<td>Information Processing and Management</td>
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<td>IS</td>
<td>Information Systems</td>
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<td>ISP</td>
<td>Internet Service Provider</td>
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<td>IT</td>
<td>Information Technology</td>
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<td>ITA 3</td>
<td>Information Technology Applications Unit 3</td>
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<td>ITA 4</td>
<td>Information Technology Applications Unit 4</td>
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<td>ITiS</td>
<td>Information Technology in Society</td>
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<td>KLA</td>
<td>Key Learning Area</td>
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<td>LOTE</td>
<td>Languages Other Than English</td>
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<td>NAP</td>
<td>National Assessment Program</td>
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<td>NAP-ICTL</td>
<td>National Assessment Program Information and Communication Literacy</td>
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<td>NBN</td>
<td>National Broadband Network</td>
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<td>NSIP</td>
<td>National Schools Interoperability Program</td>
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<td>NSSCF</td>
<td>National Secondary School Computer Fund</td>
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<td>NSW</td>
<td>New South Wales</td>
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<td>NTTPP</td>
<td>New Teacher and Principal Notebook Program</td>
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<td>OLPC</td>
<td>One Laptop Per Child Australia Project</td>
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<tr>
<td>Abbreviation</td>
<td>Full Form</td>
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<td>PC</td>
<td>Personal Computer</td>
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<td>PD</td>
<td>Professional Development</td>
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<td>PISA</td>
<td>Program for International Student Assessment</td>
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<td>PLANE</td>
<td>Pathways for Learning Anywhere, Anytime; A Network for Educators</td>
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<tr>
<td>RRMA</td>
<td>Rural, Remote and Metropolitan Areas Classification</td>
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<td>SD 3</td>
<td>Software Development Unit 3</td>
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<td>SD 4</td>
<td>Software Development Unit 4</td>
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<tr>
<td>SIF</td>
<td>System Interoperability Framework</td>
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<td>STEM</td>
<td>Science Technology Engineering and Mathematics</td>
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<tr>
<td>TALIS</td>
<td>Teaching and Learning International Survey</td>
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<td>TSSP</td>
<td>Technical Support to Schools Program</td>
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<td>TTF</td>
<td>Teaching the Teachers of the Future</td>
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<tr>
<td>VCAL</td>
<td>Victorian Certificate of Applied Learning</td>
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<td>VCE</td>
<td>Victorian Certificate of Education</td>
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<td>VELS</td>
<td>Victorian Essential Learning Standards</td>
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<td>VET</td>
<td>Vocational Education and Training</td>
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Chapter 1: Thesis Overview

The past thirty years have seen a dramatic increase in the specific application of digital technology in most businesses and industries, and more generally, in society. Usually, no encouragement is necessary for young people to access and use digital tools. However, preparing them for a future in a technologically disrupted society requires them to have a greater variety of skills and understanding beyond using social media and web browsers.

There is consistent evidence demonstrating that Australian student attainment in ICT Literacy and involvement in computer study has not increased over time. In fact, the more students use technology the less interested they become in studying this field (McLachlan, Craig & Coldwell-Neilson 2016).

Computing education has had a long history of alterations and problems including (see Chapter 2):

- hurried and aimless development
- a long time to be accepted
- changes in school responsibilities
- relocation in subsequent curriculums
- progression from an individual to a generalised learning area
- its complex nature
- poor promotion in schools
- difficulty in attracting teachers and students
- low numbers undertake senior and tertiary studies
- often taught by teachers untrained in the discipline
- teachers expected to be proficient in this area regardless of their discipline
- requires regular equipment updates
- unable to keep up with technological developments.

Australian national and state governments have invested heavily in programs and initiatives to support and overcome these issues, although many still exist and new ones are appearing.

Research has shown that the supply of qualified ICT professionals is decreasing
while the demand is increasing, and the continuation of the ICT workforce depends on skilled ICT personnel (Multimedia Victoria 2012). The workforce relies on educational institutions to develop ICT capabilities in students but with fewer interested students, shortages of skilled ICT workers will continue. Researchers have developed strategies to improve ICT student numbers; however, to date, there has been little change. The current system does not seem to be meeting student, teacher or employment needs.

The need exists for inspiring ICT teachers (Sterling 2012). Teachers form an important link to student learning and an investigation into how to meet their needs to assist in improving student outcomes in ICT seems warranted. Through highlighting teachers’ experiences of ICT in education, the issues of the past can be utilised to improve the future, and the outcomes used to highlight where problems still exist.

1.1: Education Influences

Two prominent educational studies, Hattie (2003) and The Report of The Working Group on Education for Science and Technology to the Victorian Government through the Hon. Ian Cathie, Minister of Education (Working Group) (1987), conducted research a quarter of a century apart. They defined similar influencing factors on students and their learning. Hattie (2003, p. 3) identified six major influences of variance related to student achievement (shown in Figure 1.1), while the Working Group (1987, p. 3) defined five factors relating to students’ subject choice (shown in Table 1.1).

Hattie (2003) indicated that apart from the students themselves the next largest influence on achievement are their teachers. Similarly, the Working Group (1987) detailed that four out of the five school influences on students’ choice involved their teachers.
Figure 1.1: Hattie’s percentage of achievement variance (Hattie 2003, p. 3)

<table>
<thead>
<tr>
<th>Factor</th>
<th>Issues</th>
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<tr>
<td>School influences</td>
<td>Curriculum content</td>
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<td></td>
<td>Teaching practices</td>
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<td>Teachers’ attitudes</td>
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<td>Teachers’ professional development</td>
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<td>Quality and quantity of teachers</td>
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<td>Student perceptions</td>
<td>Ability to succeed in Maths, Science and Technology at secondary school</td>
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<td></td>
<td>and also at post-secondary levels</td>
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<td></td>
<td>Their perceptions about future employment</td>
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<td>Home and demographic influences</td>
<td>Socioeconomic status</td>
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<td>Location</td>
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<td>Ethnic origin</td>
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<td>Gender</td>
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<td></td>
<td>Parental expectations</td>
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<td>Community issues</td>
<td>Images of technology</td>
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<td>Images of employment and careers</td>
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<tr>
<td>Transfer between and entrance to tertiary study</td>
<td>Selection criteria for courses</td>
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<td></td>
<td>Availability of bridging courses</td>
</tr>
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<td></td>
<td>Transfer between and within post-secondary institutions</td>
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</tbody>
</table>

Table 1.1: Working Group’s factors that interact and influence students’ subject choices (adjusted from Working Group 1987, p. 3)
The Organisation for Economic Co-operation and Development (OECD 2005, p. 2) described influences on student learning as including attributes of the students, their family, their peers, their school, the curriculum, and their teacher ‘skills, knowledge, attitudes and practices’, therefore, confirming and enhancing those suggested by Hattie (2003) and the Working Group (1987).

Secondary schools, in particular, are an essential connection in developing quality students, where teachers are crucial to student learning (Department of Education, Employment and Workplace Relations [DEEWR] n.d.c; Hattie 2003). The quality of education provided is dependent on well-qualified and inspirational teachers and their schools (Adoniou 2013; DEEWR n.d.c; Hattie 2003; OECD 2005; Sterling 2012; Working Group 1987). Stephenson et al. (1998) noted that teachers are role models to students, influencing students in their classes in a number of ways. Teachers inadvertently impart their own behaviour and values on students and these additionally affect student-to-student relationships within the class (Stephenson et al. 1998). Genrich, Toleman and Roberts (2014) have shown that teachers and the curriculum impact significantly on students’ lives and their IT related career decisions. Furthermore, according to Hattie (2003, pp. 2-3) the answer ‘lies in the person who gently closes the classroom door and performs the teaching act – the person who puts in place the end effects of so many policies, who interprets these policies, and who is alone with students during their 15,000 hours of schooling’.

1.2: The ICT Pipeline

This research views the ICT pipeline as circular and overlapping rather than linear and unidirectional. The State Government of Victoria (2010, p. 20) published an ICT framework, which detailed the interrelations between ICT education and research, the ICT industry, and government and business users (Figure 1.2). This framework lists increased productivity, economic growth, prosperity, solving large problems and quality of life as contributing factors. Interruptions to any ICT framework area cause disruptions to the ICT pipeline flow.
The educational system passes through policy makers and educational authorities, educational providers, educational instructors and supporters, and educational receivers. Koppi and Naghdy (2009) defined the stakeholders in tertiary ICT studies as the government, professional bodies, employers in the ICT industry, academic staff, graduates’ in the workplace, high schools, students, and the community. Even though the organisation of education has a top-down approach, the supply of future workers comes up from the bottom end. The expectation of educational institutions is that students gain 21st Century skills including a thorough grounding in ICT operation and use, which will enable them to undertake further study or to obtain employment. Tomorrow’s ICT teachers and ICT professionals are among today’s school students.

1.3: Research Contribution, Aims and Questions
This research project aims to investigate a problem and build a theory that encapsulates the perceptions of schoolteachers in relation to ICT in education. The
research will contribute to existing knowledge of teachers’ opinions of their technological abilities and students’ lack of interest in ICT, it will inform educational authorities of teachers’ perceptions of ICT education and assist future teacher training with the teaching of ICT.

The investigation aimed to highlight the current inhibiting issues that ICT teachers faced and then further examined two core factors through teachers of other discipline areas who may or may not have high interests in ICT education. Gaining teacher feedback on ICT education and ICTs in education will contribute to our understanding of why fewer students are studying ICT.

Therefore the main research question is:

*How can teachers improve the factors affecting the successful teaching of ICT in schools?*

In order to address this multi-faceted question, the following underlying questions will assist in separating the details into smaller and more specific questions.

1. *What range of issues do ICT schoolteachers encounter in relation to ICT education?*
2. *Which inhibiting core factors affect Victorian ICT schoolteachers abilities in educating their students?*
3. *How does the first core factor influence teacher daily activities?*
4. *What experiences have schoolteachers encountered in managing the second core factor?*
5. *How do schoolteachers think they can improve their situation in the future in relation to these core factors?*

### 1.4: Research Structure

The methodology and methods behind this research are multifaceted. The use of Grounded Theory ties together multiple philosophies, research streams, purposes, data types, and data collection techniques in a two-phase sequential mixed methods study of teachers’ experiences of ICT education.
The research flow diagram above (Figure 1.3) details how the research objective components link together to form the overall research project. The research introduction precedes a literature on ICT in education that includes the development of computing in schools and recent influencing ICT policies. The first phase explored the views of ICT teachers at Victorian schools by collecting qualitative data; the analysis leads to the formation of a tentative substantive model. Selected themes identified during the first phase define the literature for the second phase. The second phase was descriptive and collected quantitative and qualitative data from schoolteachers to build upon the collected data from the first phase. Both phases underpinned by grounded theory research, methods and design; provide the basis to expand the model into a general substantive theory.
1.5: Definitions of Terminology

Definitions of terms used in this thesis are in relation to their underlying meaning, relationship to, and use in this research.

The definition of *Perception* adopted here is from the field of Psychology. To be able to form a perceptive view, the perceiver must be able to know about the environment that they are forming an opinion about (Sekuler & Blake 1985, p. 495).

The acquisition and processing of sensory information in order to see, hear, taste, smell, or feel objects in the world; also guides an organism’s actions with respect to those objects. Perception may involve conscious awareness of objects and events; this awareness is termed a percept.

The *Commonwealth* refers to the national Commonwealth of Australia, which is the top layer of government overseeing eight Territories and States that make up Australia. The state of Victoria occupies 3% of Australia's land mass, has approximately 25% of Australia's population, and almost 30% of Australia's ICT workforce (Australian Bureau of Statistics [ABS] 2013; Australian Computer Society [ACS] 2013; Geoscience Australia n.d.).

The Victorian educational system uses the term *Framework* to describe a guide that supplies information to schools and their community with broad statements to provide them with the necessary outlines to develop and deliver a curriculum (Board of Studies 1995b).

A *Curriculum* is a learning guide that encompasses the aspects of school management and organisation, staffing, teaching approaches, facilities, learning development, educational content, and student assessment and reporting (Curriculum Branch 1985; 1988; Department of Education and Early Childhood Development [DEECD] & Victorian Curriculum and Assessment Authority [VCAA] 2008; Minister of Education 1984; State Board of Education 1987).

The terms framework and curriculum in the Victorian Education context have been used in combination as ‘Curriculum Frameworks’ since 1985 when the first Victorian curriculum framework was released to schools (Curriculum Branch 1985).
Public Policies are documents produced by authorised government departments from a variety of areas such as legislative, political, educational, and financial (Moyle 2010).

This thesis refers to the meaning of Information and Communication Technology as defined from the Victorian educational context:

> Information and communications technology (ICT) is the hardware and software that enables data to be digitally processed, stored and communicated. ICT can be used to access, process, manage and present information; model and control events; construct new understanding; and communicate with others (VCAA 2008, p. 4).

ICT is broader than just computing, although, studies in schools revolve mainly around computing tools. The terms ICT, computers, and computing are interchangeable in this thesis. Other terms used to describe ICT are Computing and Communication Technologies, Computing, Informatics, Information Technology, Information Systems, Computer Science, Computing and Information Technology (Avgerou, Siemer-Matravers & Bjorn-Andersen 1999; Benson & Standing 2008; Bigum & Rohan 2004; The British Computer Society Schools Expert Panel Glossary Working Party 2008; Lynch 2007; Staehr, Martin, & Byrne 2001; Watson 2006). Victorian schools use a large variety of ICT tools that includes devices such as Desktop Computers, Laptops, Notebooks, Netbooks, Tablets, mobile phones, digital cameras and Electronic Interactive Whiteboards.

ICT Literacy is the valuable knowledge required by all users of ICT, not just school students. The definition of ICT Literacy adopted for use in Victorian Schools is:

> [T]he ability of individuals to use ICT appropriately to access, manage and evaluate information, develop new understandings, and communicate with others in order to participate effectively in society (Ministerial Council on Education, Employment, Training and Youth Affairs [MCEETYA] & Performance Measurement and Reporting Taskforce 2008, p. 2).

A few references to a similar term, Computer Literacy, occur in Chapter 2 as an
older term for ICT Literacy (Firkin 1984; Krystyn 1985). Additionally, the newer term, Digital Literacy, refers to computer studies in the Australian Curriculum.

Various terms for the Integration of ICT in Victorian education have appeared in curriculum documentation over the years. Terms have consisted of embedded, blended, underpinned, interwoven, interdisciplinary, multidisciplinary, and cross-curricula. Integrated learning incorporates aspects of one subject area into one or more other subject areas provides an interwoven and coherent curriculum so that the learnt skills and knowledge can be applied across multiple subject areas (Christophersen 2005).

In this research project, the term ICT teachers refer to a specific group of teachers; teachers who have ICT qualifications, teachers who teach ICT as a core subject even though they do not hold ICT qualifications, and teachers who have a high interest in ICT education. To distinguish one group of teachers from another, the terms non-ICT teachers and not-ICT qualified refers to those teachers who are not ICT teachers. The general term of teachers includes any person instructing students in a classroom environment and includes school leaders, classroom teachers, and classroom aides.

The terms core refers to classes that focus wholly on one subject, for example, computer studies.

1.6: Limitations of Boundaries and Scope

The scope of this research was limited to examining teachers’ perceptions of ICT education. Teachers are very influential on student learning and thus have become the focus of this research. The research does not specifically investigate other influences suggested by Hattie (2003), the OECD (2005), and the Working Group (1987). These include students, their homes, family, schools, communities, peers, principals, curriculum, or tertiary entry requirements. Additionally, the research does not focus on students’ computer use in schools, the depth of their computer studies, gender issues, or their personal use. Furthermore, a significant body of literature exists in these areas whereas exploring the issue from the perspective of teachers warrants further investigation. The geographical focus of this research is in the Australian context and limited to the State of Victoria.
1.7: Research Limitations

No matter what type of, or where, research occurs there will always be limitations and issues that are beyond the control of the researchers. This research eventuated with the following limitations in mind:

- The information obtained is from individual teachers. People have a right to their own perceptions of the world, and those presented may not be in accord with those of other teachers.
- Results are specific to the teachers, their schools and students at the time of data collection.
- Geographically, the research was limited to Victoria. An attempt to gather data from across Australia did occur, however, there were no responses.
- Although the Australian national curriculum is under implementation, each state, territory, and school have individual control of this process. Therefore, results from this research may not be applicable Australia-wide.

1.8: Summary of Chapter 1

This chapter set out to introduce the research project and provided information on why, how, and what is expected to be achieved in this research, and began by describing the problem and discussing the importance of teachers in education. The chapter then described a circular ICT pipeline, research aims and questions, summarised the research structure and defined important terms. Finally, it detailed the research boundaries and project limitations. The following chapter describes computing in Australian school education since the 1980s.
Chapter 2: ICT in Education

Having provided an overview of the thesis in chapter 1, this chapter describes the setting for the study. To set the context, this chapter begins with a brief look at the history of computers in education in Australian schools, it then looks into Victorian curriculum frameworks and their coverage of ICT learning. The chapter then describes and discusses implications of more recent ICT strategies relating to school connectivity and computer access, examines student outcomes in ICT education in Victoria. Finally, it describes teaching with computers, posits the research problem and formulates the research questions. A timeline of events discussed in this chapter appears in Appendix A.

2.1: Early Accounts of Computing in Australian Schools

2.1.1: The Beginnings of Computing Education

The earliest recorded mention of computing education, as it was then known, was the use of mainframes and punch cards within Australian schools in the 1960s (Pirie 1994), with Jones, McDougall and Murnane (2004, p. 64) reporting that school computing was ‘almost non-existent’ before 1970. Computing began appearing in Australian schools during the 1970s and 1980s (Bigum et al. 1987; Hammond 1994; Larkin & Finger 2011), although most schools did not have computers available for student use (Newhouse 1987; Tatnall & Davey 2006). Often, assignment of computers was to school administration, which changed the way that office staff performed their job considerably; staff now required professional training in the knowledge and use of computers in relation to their position (Blackmore et al. 1996). During the early 1980s, computers become more widely used in businesses, industry and education, with the public also starting to use them for leisure and entertainment (McDougall 1980; Public Service Board 1984).

Computers and computer education was not seen as important for Victorian secondary education in 1980 and had low priority (Secondary Computer Education Committee 1980), although the Education Department detailed computers to be an ‘essential element’ of education for all levels (Firkin 1984, p. 17). The low number of computers in schools did not deter educational authorities
from including computing in the curriculum. Four Australian states, New South Wales (NSW), Western Australia, Tasmania, and South Australia, released policy documents in the early 1980s that set out directions for consideration of computers in education (Pirie 1994), with Western Australia instructing secondary schools to allow students to interact with computers (Education Department of Western Australia 1980 as cited by Newhouse 1987). The Commonwealth Schools Commission released national guidelines for computer education in 1983, including guidelines for teacher professional development (PD), computer use across the curriculum, access by disadvantaged groups including girls, equipment and material standardisation, and the development of a computing curriculum (Pirie 1994). Still, gaps existed between policies and implementation (Krystyn 1985), and the provision of equipment would require a phased-in program for several years (Minister of Education 1984). Firkin (1984) stated multiple reasons for computer education: to provide hands-on learning and vocational preparation, to introduce and improve basic computer skills and enthusiasm toward computers, improve students’ learning outcomes, include creative and logical thinking into education, and reduce suspicion and resistance to computers.

The education system was slower to respond to computer influences in society than some individual schools (State Board of Education 1985). Often the development of computing education took an ad-hoc path (Krystyn 1985). Some schools incorporated computers into education prior to computer policy formation, most had to overcome logistical issues, and others develop appropriate computer use for their own needs (Firkin 1984; Krystyn 1985). The Minister of Education (1984, p. 19) planned for technical competence to include learning to ‘develop competence with computers and information technology and understand their social effects, and appropriate those aspects of this technology which contribute to learning’.

Negative feelings and social attitudes existed toward computers. Many of those outside of the computing profession felt powerless and helpless when it came to computers, were scared and carried resentment and apprehension toward computers, and saw them as reducing employment opportunities (McDougall 1980). McDougall (1980) reported that it was essential to include computers into education to overcome these negative attitudes. Over time attitudes began to
change. In Krystyn’s (1985) study of computer use in thirty secondary schools, she concluded that some teachers and most students and parents were enthusiastic about the use of computers in education.

2.1.2: Initiatives to Encourage Computing in Schools

Initiatives in the 1970s to introduce and support schools in computer education included the creation of committees, mobile displays, and conferences. The Commonwealth Government established the Commonwealth Schools Commission National Advisory Committee on Computers in Schools in early 1973 (Pirie 1994; Tatnall & Davey 2008). The Committee’s aims were to provide funding, leadership, and to organise computer education resources in the states and territories (Pirie 1994; Tatnall & Davey 2008). In 1978/79, a Computer Travelling Roadshow visited Victorian secondary schools with a tape drive computer to promote computing in education to teachers, and to demonstrate extended uses of computers (Bigum et al. 1987). In June 1979, a regional computer conference attracted representatives from twenty-five schools; although only two of these schools had their own computer, four schools shared use of a computer with universities, and three schools used teacher owned computers (Tatnall & Davey 2008).

The 1980s continued with the formation of curriculum content and funding for computers in education. One of the aims of the Victorian Secondary Computer Education Committee was to produce Computer Awareness guidelines and to advise secondary schools about computing (Secondary Computer Education Committee 1980). Adoption of these guidelines and advice were the responsibility of individual schools and became further plagued by underutilisation of computers in secondary education (Tatnall & Davey 2006). Together the National Computer Education Program (Krystyn 1985) and the National Computers in Schools Program (State Board of Education 1985), both released in 1984, assisted Victorian schools through provision of in-service teacher training, teacher support through regional centres, funding for secondary school programs, and funding for equipment and materials, (Krystyn 1985; State Board of Education 1985). The aims were to provide technical knowledge to all Australian students (State Board of Education 1985).
A non-government initiative between Sydney University, the NSW education system, and IBM concentrated on a two-year collaboration (Macrae 1989). The ‘IBM Computer Education Project’ saw five schools in 1985 supplied with computer equipment set up in a computer room and training of four teachers from each school (Macrae 1989). The teachers then, in turn, educated other teachers in their school; resulting in most teachers reaching at least an introductory level of computer knowledge, half to intermediate level, and almost a third to advanced level (Macrae 1989). During the project, interest in and acceptance of computing by school staff increased. Although, a few years later when the project had terminated, support issues and funding became a concern (Macrae 1989).

2.1.2.1: Computer Funding Reports

Reports of Commonwealth funding for these early years, 1984 to 1986, of computer education vary. Pirie (1994) depicts that Commonwealth funding for 1984 amounted to $4.8 million for government schools and $1.2 million for non-government schools. Similarly, the State Board of Education (1985) detailed Commonwealth and Victorian state funding was limited to secondary schools and combined was approximate $7 million for government schools and $1 million for non-government schools. While Tatnall and Davey (2006), states $19 million related to the Commonwealth Computer Education Program. The funding had to encompass all related computer education issues such as teacher training, curriculum development, equipment, software, support services, integration, and student classes (Pirie 1994; Tatnall and Davey 2006; State Board of Education 1985). Schools could use only a proportion of the funding to buy equipment (State Board of Education 1985). Pirie (1994) noted that these funds would have to stretch extremely thinly if they were to cover all the priority areas identified. Funding for computer equipment was a problem, schools had to raise funds from multiple sources to purchase computers; they obtained finances through school councils, parents, government grants, fundraising, and faculty budgets (Krystyn 1985).

2.1.3: Emergence of Computing Teachers

Many of the first teachers of computing self-selected to teach in the discipline due to their enthusiasm about, dedication to, or obsession with computers (Billum
They were small in number and mostly consisted of males who came from the Mathematics or Science areas (Bigum 1990; Firkin 1984; Tatnall & Davey 2006). These teachers, though self-educated in computing, were in charge of computing equipment and the teaching of computing (Bigum 1990; Krystyn 1985). However, as the demand for teachers of computing grew, teachers with a little background in the area were co-opted. There was even an instance where a touch-typing teacher had to teach computing due to keyboard familiarity (Harris 2007). Feelings of isolation and insecurity existed among these teachers. Teachers with little experience had to obtain support from others through conferences, associations, groups, meetings and computing publications (Jones, McDougall, & Murnane 2004; Pirie 1994).

Most of society and many schoolteachers knew very little about computing and had rarely seen or even used one (Firkin 1984; Krystyn 1985). During the early days of computers in schools, there were concerns that computers would replace teachers. Many teachers, therefore, were suspicious of, feared, and resented computers, or had feelings of inadequacy, and could not see the value of computers for education (Bigum et al. 1987; Blackmore et al. 1996; Firkin 1984; Krystyn 1985). These teachers were uninterested in incorporating or using computers in the classroom due to their lack of knowledge, confidence, and expertise (Blackmore et al. 1996; Krystyn 1985). Computers were continually associated with Mathematics and Computer Science (CS), seen as extensions to calculators, and were often taught by teachers of these subjects (Krystyn 1985; Lee 2004; Pirie 1994). Although a few teachers had learnt some computing skills, they felt that they lagged in the computing stakes due to lack of access to a computer to develop and improve confidence, build familiarity with computers and computing, and to keep abreast with changes (Blackmore et al. 1996; McDougall 1980). Once use of computers became more common, teachers found that rather than reducing their workload as informed, computers increased their workload, and they had to work harder and faster to keep up with their duties (Blackmore et al. 1996).

2.1.3.1: The Rise of Teachers’ Computer Training

The late 1970s and the 1980s brought about great changes and growth to the development of teachers with computing skills (Jones, McDougall & Murnane
2004; Krystyn 1985). Previously training for computer teachers in Australia was almost non-existent, teachers of all other subjects, for example, English, required specialist expertise and qualifications, but this was not so for computing teachers (Firkin 1984).

The introduction of computing classes into schools brought about the need for pre-service teacher training and the encouragement for in-service teachers to uptake computer PD (Jones, McDougall & Murnane 2004; Victorian Institute for Secondary Education [VISE] 1984). Difficulties existed; universities had not yet created programmes for teachers, although some units did exist in other courses (Tatnall & Davey 2008). Jones, McDougall and Murnane (2004) recorded that in 1975 Victorian Post-Graduate teachers could undertake Computer Studies, while undergraduate teachers studying Mathematics had access to elective computing subjects. Early computing teacher training recorded in Tasmanian detailed that undergraduate teachers could undertake a recognised computing component that entitled them to classification as a computing teacher (Wills 1981 as cited in Pirie 1982). At times, a few recently graduated Mathematics and Science teachers who had undertaken some computing studies had the responsibility to teach computing classes, even though it was not part of their job description (Jones, McDougall, & Murnane 2004). McDougall (1980) recommended teacher training include computer components, and that CS teachers should have the equivalent of two years of tertiary education in the computing field. In 1981, a Post-Graduate secondary teacher optional CS module became available at University of Melbourne; covering mainly content for senior secondary level education (Jones, McDougall & Murnane 2004). The early to middle 1980s brought about an undergraduate secondary teaching elective ‘Teaching with Computers’ at Victoria College (Krystyn 1985, p. 3). By 1984, a compulsory ‘IT in education’ unit was included at Monash University for secondary Post-Graduate teacher education students (Jones, McDougall & Murnane 2004, p. 70).

Some schools that had decided to offer Computer Awareness classes, came to the realisation that most of, if not all of, their teachers would have to be confident and acquainted with computers in order to talk about computers with their students and use computers across the curriculum (McDougall 1980; Pirie 1982). Teachers would need at least basic computer skills related to ‘subject-specific components’
(McDougall 1980, p. 17), therefore a huge need for computer education for teachers arose (Pirie 1982). Teachers reported that the expectation was that they learnt about computers even though few or no PD opportunities were available (Blackmore et al. 1996), and there was a lack of computer curriculum support (Krystyn 1985). A continual need for teacher computer development existed; it was important that they had hands-on experience to overcome negative attitudes to computers and education (Firkin 1984). However, in 1985, Krystyn reported that professional development for teachers was beginning to increase. The creation of Territory and State Computer Education Centres during the 1980s gave teachers’ access to PD, software, curriculum, and teacher support; later that decade, additional support was available through computer education consultants at regional offices (Tatnall & Davey 2008).

2.1.4: Commencement of Computing Classes

The beginning of computing classes brought about a change in the way students and teachers learnt. Content could be on a screen as opposed to a book, writing was initiated through a keyboard or other input device, listening included electronic sounds, printers could produce neat and legible outputs, and information could be accessed in a different way (Bigum et al. 1987).

Initially, computing classes began without physical computer access, with students learning how to talk about computers and working out how to solve scientific and mathematical problems as if using computers (Lee 2004; Moursund 1983). The few Australian secondary school computing classes available in the 1960s and early 1970s consisted mainly of programming using punch cards; students had to wait for mainframe access to batch-process their cards to determine if their programme was successful (Newhouse 1987; Pirie 1994).

The development of computer course content began in a haphazard fashion in Australia, commonly by the early enthusiastic teachers, as mentioned in Section 2.1.3, who designed classes for their students (Firkin 1984; Jones A 2004; Jones AJ 2004; Jones, McDougall & Murnane 2004; Krystyn 1985; Pirie 1994; Tatnall & Davey 2008). This manner of development produced inconsistency across schools. McDougall (1980) recommended to the Computer Policy Committee that teachers with relevant skills assist in the development of consistent course
Initial recommendations for computer studies consisted of a Computer Studies subject for younger secondary students, Computer Science (CS) and optional components in senior Mathematics courses, and a senior class that bridged the content from Computer Studies to CS (McDougall 1980). Computer Studies should consist of a variety of content that encouraged hands-on experience, implications for society, computing equipment and their internal workings, computing techniques, technological development, computer jargon, and an introduction to programming (McDougall 1980).

2.1.4.1: Computer Studies for Senior Students

Consistent academic effort over a number of years brought about the introduction of CS to senior secondary students in the Higher School Certificate (HSC) in Victoria in 1981 (Jones, McDougall & Murnane 2004; Tatnall & Davey 2004). A few Victorian secondary schools offered CS to senior students with little content input from the education department, although at this time some university academics considered the content too difficult and inappropriate for even secondary students (Tatnall & Davey 2004, 2008).

Eleven other HSC subjects in the early 1980s had a word processing or computer component available (Firkin 1984), although, students had sparse access to computers. The first IBM Personal Computer (PC) was only a recent release in the United States in August of 1981 (IBM n.d.). Different aspects of computer learning for senior students were located in different subjects due to their perceived difficulty; programming options were located in ‘hard’ subjects such as Mathematics, and word processing in ‘soft’ subjects such as Secretarial Studies (Firkin 1984, p. 36). Krystyn (1985, p. 35) suggested that senior CS classes were viewed as an ‘elitist subject’. These views did not seem to deter students from studying them with enrolments on the rise. Student uptake of senior school CS from 1983 to 1984 doubled at government high and technical schools, at independent non-Catholic secondary schools enrolment trebled, and at Catholic independent secondary schools, numbers quadrupled (Firkin 1984). Senior CS content consisted of units in societal implications, system software, algorithms, programming, input/output devices, and file, computer and data structures.
Additionally, students could select an optional unit of either Computer use in Government and Business or Computer use in Engineering and Science (VISE 1984).

2.1.4.2: Computer Studies for Younger Secondary Students

Computer Awareness (CA) classes were developed for middle secondary students. McDougall (1980, p. 6) advised that all Victorian secondary students ‘should be given some insight into computer technology and its implications’, to gain sufficient knowledge to discuss and appreciate computing, and to give as many students as possible the chance to program. McDougall (1980, p. 10) proposed that the offering of CA should be independent of subject content, although not intended to be ‘a subject or course on its own, separate from the other subjects in the curriculum.’

Once introduced, CA classes concentrated on practical rather than theoretical learning, with little or no computer programming involvement (Tatnall & Davey 2008); even though CA curriculum documents in Victoria and South Australia contained ‘many theoretical segments’ they were not often taught (Dudley 1984, p. 258). For example, one school in Victoria developed CA content on an entirely practical approach providing students with the opportunity for hands-on experience (Dudley 1984).

Computer Awareness guidelines differed between school types and generally included introduction to computers, word processing, computer graphics, computer games, use of spreadsheets and databases (Dudley 1984). The guidelines for secondary students were historical computer development and computer structure for 15% of the course, hands-on operation and simple programming, 25%, computer use in industry, business, and homes, and implications of computers in society, 60% (Secondary Computer Education Committee 1980). In contrast, those for technical schools aimed toward industry and employment and consisted of 40% implications and applications, 30% use, 20% structure, and 10% history (Computer Studies Curriculum Committee 1983).

Computer Awareness classes devised for Australian students did not distinguish between Computer Awareness and Computer Literacy, unlike CA classes in America (Moursund 1983; Tatnall & Davey 2008). There was confusion on what
Computer Literacy actually referred to, in Firkin’s (1984, p. 36) Victorian research, teachers had differing views on what Computer Literacy meant - ‘some believed that programming ability is the bottom line of computer literacy, some were willing to settle for some level of end-using skill, while others believed social awareness is sufficient’.

2.1.5: The Dawn of Student Computer Access

Information provided to the Computer Policy Committee recommended that each school should own a computer system and associated resources (McDougall 1980). The cost and accessibility of computers hampered their introduction into education, prohibiting many schools from purchasing equipment; standardisation of equipment was an issue, and they quickly become out-dated (McDougall 1980; State Board of Education 1985; Tatnall & Davey 2008). Prior to the late 1970s, few computers were available for educational use; students only had mainframe access through universities, businesses, or at State Computing Centres (Newhouse 1987; Tatnall 2013; Tatnall & Davey 2008).

The introduction of smaller and more portable computers brought about new opportunities for schools; they were more affordable, expanded use to include non-numerical, theoretical, and practical applications (Lee 2004; Newhouse 1987; Pirie 1994; Watson 2006). However, these early computers had a number of limitations including no internal storage, model compatibility, access security, limited processing memory, could only load and run one program at a time, and they had to be connected to a display screen, although they were able to be used stand-alone or interconnected (Public Service Board 1984).

Firkin’s (1984) study indicated that computer distribution among Victorian schools was uneven; very few primary schools had computers, post-primary schools averaged two computers, although some schools had none and others more than 10. The distribution of computers indicated that computing was more important in post-primary schools than in primary schools and that technical schools placed greater emphasis on computer education than high schools (Firkin 1984). Albeit, Tatnall and Davey (2008) reported that by the middle of the 1980s most secondary schools and many primary schools had a computer lab.

Computing education started out in schools with the equipment kept behind
locked doors in computer laboratories, taught periodically to students by specialised computer teachers, and considered ‘as an add-on or an extra’ (Gerstner et al. 1994, p. 12). Computers labs were frequently located in particular school departments and were mostly reserved for core classes or monopolised by students studying those subjects (Bigum et al. 1987; Keane 2014; Krystyn 1985). The computers in labs were often internally networked, which reduced their mobility, and those that were on mobile trolleys were restricted to a single floor (Krystyn 1985). The lack of access to computing equipment created problems, many students keyboarding skills were limited and computing education was restricted (Krystyn 1985; Jones, McDougall & Murnane 2004).

Adoption often depended on the school principals’ personal enthusiasm towards computers; different schools viewed computers differently with varying priorities and placed them accordingly (Blackmore et al. 1996; McDougall 1980). For schools with computer equipment, irrespective of the number of computers possessed, inequalities existed. Not all schools provided all of their students with a computing experience, not all schools offered CA classes, the CA curriculum was still under development and policies had not yet been defined, students that did have access to CA classes had to choose between them and other classes, software was not fully utilised and few schools were externally connected (Krystyn 1985).

Early attempts at integrating computers into education were unsuccessful with very few schools achieving computer integration ‘across the curriculum’; the lack of access and portrayal of computers were failing to interest students in computing (Krystyn 1985 p 15). Fitting in computer education into an already overcrowded curriculum continued to be problematic. Computing education had to fit into essential subjects, and one way to do this was simply to regard computers as ‘tools’ to support teaching (Newell 1989 p 13). Nevertheless, teachers found this hard to implement (Newell 1989).

The 1990s saw the release of newer computers that were more user-friendly; these were smaller and more portable, cheaper to purchase, and had greater capabilities and power (Pirie 1994; Watson 2006). At this time, the everyday role of computers began to change with the growth of the Internet and mobile technologies flourishing (Pirie 1994; Watson 2006). Today, access to computing
equipment has improved considerably. All students at a secondary school in 1977 had to share one computer (Tatnall & Davey 2006), ten years later a whole class shared a single computer (Bigum et al. 1987), while in 2014 many children at school have daily access to computing devices (Australian Curriculum, Assessment and Reporting Authority [ACARA] 2015b; McLachlan, Craig, Coldwell-Neilson 2016). Modern computers are a ‘vital tool’ (Jones & Broomham 1994, p. 188) and have changed the way information about everyday details was recorded, stored and compiled (Martin 2002).

2.1.6: Past Opinions on the Roles of Computers

Computer-enabled tools are currently a part of many aspects of daily life in the 21st Century; many of today’s youth often possess their own technological devices (Salt 2015). Extant publications detailed that computers perform numerous roles in learning and span different learning directions.

Computers in education have been characterised as performing three roles or functions, a tutor, a tool, and a tutee (Taylor & Forsdale 1980). A computer, employed in its tutor role replaces a teacher, for example, through computer-assisted education, and in its position as a tool, a person uses a computer to apply it in a useful capacity, such as accomplishing an educational task (Scott, Cole, & Engel 1992; Taylor & Forsdale 1980). In its tutee role, a computer is in the student mode where the human operator teaches it, such as through programming (Taylor & Forsdale 1980).

The late 1970s and early 1980s saw computers becoming accessible to the public with the sale of microprocessor equipment (Tatnall & Davey 2008). During this time, Pirie (1982, p. 3) described ‘the depth and breadth of the study’ of school computing as fitting into four categories; teaching with computers, teaching by computers, teaching about computing, and teaching computing. Similarly, Bigum et al. (1987, p. 18) described two broad categories that arose from Australian school computer study programs, ‘learning with or through’ computers, and ‘learning about’ computers.

Learning with computers means using the computer for teaching and learning as a tool (Bigum et al. 1987; Pirie 1982; 1994; Tomei 2005). Tomei (2005, p. xii) describes this level of use as the ‘practice level’, with learning experiences
supported by computing equipment. Teachers use computers as tools to assist students by enhancing their learning environment through software programs such as word processors (Bigum et al. 1987; Pirie 1982; 1994). Taylor (2003) further described four activities that students and teachers engaged in with digital technologies, accessing information, communicating with others, collaborating to work together, and experiencing the world.

Obtaining the knowledge of ICTs as a specialised subject is learning about computers (Bigum et al. 1987; Pirie 1982; 1994; Tomei 2005). Usually, specialised ICT teachers conduct this type of class with middle and senior secondary students through elective and/or senior ICT studies (Pirie 1982; 1994). Teachers teach the ‘technology as a content area’ at the ‘knowledge level’ (Tomei 2005, p. xii) and students learn issues such as the mechanics of ICTs, how information is processed, the role of computers in society, and computer impact on humans (Pirie 1982; 1994).

Despite these clear distinctions, Bruce and Levin’s (1997, p. 84) opinion was that the integration of technology teaching into other subject areas brought about a change in ‘the traditional lines between learning about technology and learning through technology’ and that they ‘are beginning to blur’. Twining (2014) therefore suggested that the term ICT now covers three learning areas, learning about computing, learning with computers, and learning about the software, hardware and infrastructures supporting the technology.

Jones, McDougall, & Murnane (2004, pp. 71-72) defined that the role of computing education had altered considerably, from being ‘central to the activity’ in 1970, to ‘a means to an end’ in 2003. They imply that progression has gone from the computer being the focus of the activity, as in testing programming on a punch card, to using the computer solely to produce outcomes where it is not the focus of the activity, such as creating or editing a document (Jones, McDougall, & Murnane 2004).

2.2: Victorian Educational Curricula and Computing

Victorian school education from at least 1872 to the 1970s was guided by prescribed centralised curricula that changed very little, they were described as ‘too specialised’ and ‘lacking relevance’ to students’ lives (Minister of Education
1984, p. 3; VCAA 2014a). Curriculum and education foci began shifting away from these centrally imposed syllabuses with the development of school-based curricula through the formation of educational frameworks that were to utilise decision-making and curriculum development at the school level to benefit its own community (Minister of Education 1984; VCAA 2014a).

The middle of the 1980s saw significant changes to Victorian educational policies with schools and school councils given the authority to ‘determine their own curriculum policies within general state-wide guidelines’ (State Board of Education 1987, p. 4), made possible due to amendments to the Education Act (Minister of Education 1984; State Board of Education 1987). The change in governance enabled schools to plan a curriculum that was applicable to a changing society that met their individual needs, giving schools a greater degree of control over their curriculum and its content, and how to deliver it to students (Minister of Education 1984; State Board of Education 1987). In fact, the high degree of autonomy and flexibility continues to this very day (Deloitte Access Economics & ACS 2015; VCAA 2014a).

Victorian guidelines, delineated in a curriculum framework, ‘outlines the general approach to curriculum and plans for resource material’ (Curriculum Branch 1985, p. 4); they also provide a broad, balanced and comprehensive based curriculum with the application of academic, practical and applied skills (Curriculum Branch 1985; State Board of Education 1987). The design of frameworks involves all the participants of a school community, provides recommendations, assists in clarifying educational aims and introduces flexibility into the learning process (Curriculum Board 1985; 1988; DEEWR 2008b; Department of Education and Training [DET] 2003).

Computers have contributed to changes in education, curriculum policies, teaching, and student learning at schools (Bigum et al. 1987). The State Board of Education (1987, p. 3) conducted a review of Victorian Curriculum Policies and determined that change was needed to acknowledge the emergence of a ‘new era in education’; it was during this time that computing was first included in education. Computing is currently seen as a fundamental component of Victoria’s social and economic infrastructure (State Government of Victoria 2010), and ‘Australian students must be prepared for living and working in a highly
technological and information rich world that is rapidly changing’ (DEEWR n.d.e, p. 1).

2.2.1: The Compulsory Learning Years

The Victorian school curriculum structure is in two sections, the compulsory learning years and the post-compulsory years. The compulsory learning years are for students aged five to 16 and in Preparatory (P), now known as Foundation (F), followed by Year 1 through to Year 10, and taught according to the educational policy frameworks (Board of Studies 1995a). In Victoria, primary schools generally offer Years P or F to Year 6, while secondary education covers Years 7 to 12; however many variations do exist.

A number of successive curriculum frameworks have been developed and implemented in Victorian schools over the last thirty years; the placement of computing education had also undergone several changes during this time (Table 2.1). A brief discussion of these frameworks follows; more in-depth information appears in Appendix B.
<table>
<thead>
<tr>
<th>Years Valid</th>
<th>Compulsory Years</th>
<th>Main ICT placement</th>
<th>Additional ICT use/instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1987 - 1988</td>
<td>Curriculum Framework</td>
<td>Commerce</td>
<td>Optional Components in Maths and Science</td>
</tr>
<tr>
<td>1988 - 1994</td>
<td>School Curriculum and Organisation Framework</td>
<td></td>
<td>Possibility of integration into other KLA’s</td>
</tr>
<tr>
<td>1995 - 2000</td>
<td>Curriculum and Standards Framework</td>
<td>Technology</td>
<td>Option to integrate technology into other KLAs</td>
</tr>
<tr>
<td>2000 - 2005</td>
<td>Curriculum and Standards Framework II</td>
<td></td>
<td>Embed ICT tools into all KLAs</td>
</tr>
<tr>
<td>2006 - 2012</td>
<td>Victorian Essential Learning Standards</td>
<td>Interdisciplinary Learning</td>
<td>Inter-discipline use</td>
</tr>
<tr>
<td>2013 - 2016</td>
<td>Australian Curriculum in Victoria</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2016 -</td>
<td>The Victorian Curriculum</td>
<td>Technologies</td>
<td>General capabilities and specialist knowledge</td>
</tr>
</tbody>
</table>

Table 2.1: Victorian compulsory curriculums from the mid-1980s, and the placement and use of ICT in education

2.2.1.1: Curriculum Frameworks, 1987 – 1994

Curriculum Frameworks for Victoria began development in 1984 and released in late 1986 for school use and adoption from 1987 (Curriculum Branch 1985). Visions of this first framework incorporated the introduction of an inclusive coherent curriculum, continuity of learning, the bringing together of school policies and programs, decision making with teacher input, and curriculum support and planning (Appendix B.1) (Curriculum Branch 1985). Curriculum Frameworks included ‘Keyboarding and Information Processing’ education as part of the major study area of Commerce and recommended that ‘keyboarding be introduced between Years 3 to 9’; students were to receive computing instruction with the aim of becoming confident and efficient with computer operation (Curriculum Branch 1985, p. 20).

During the following year an updated version, ‘The School Curriculum and Organisation Framework’, became available; its aims were to provide varied experiences for students with a balance of and connections between learning areas

<sup>1</sup> Key Learning Areas

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through an inclusive, broad, and comprehensive curriculum, and mentioned the possibility of integrating computing into other learning areas (Curriculum Branch 1988). Suggested usage of Apple Ile computers in schools was for students’ written work, word processing, simple programming and simulations, and for teachers to lesson plan, print worksheets, and perform managerial duties (Curriculum Branch 1988). This second framework had the additional name of ‘Victorian Curriculum and Organisation Framework’ (VCAA 2014a).

2.2.1.2: Curriculum and Standards Frameworks, 1995 - 2005

Superseding the School Curriculum and Organisation Framework was the ‘Curriculum and Standards Framework (CSF)’ in 1995, released partly due to the limited inclusion of values in teaching in the previous frameworks (Melbourne Graduate School of Education 2008; Stephenson et al. 1998). Schools continued to be responsible for ‘detailed curriculum development and delivery’ but now the CSF would provide the policy framework (Appendix B.2) (Board of Studies 1995b, p. 1). The introduction of the CSF saw information technology applications and computer usage now included in the Technology study area (Board of Studies 1995b). Schools and their teachers had the option of integrating various aspects of the curriculum; they could choose to combine some key learning areas (KLA) or units of work while leaving others separated (Board of Studies 1995c).

After five years, the release of a subsequent version of the CSF, the Curriculum and Standards Framework II (CSFII) occurred during 2000 and 2001. The CSFII aimed to increase ICT activities by embedding ICT tools and skills into all KLAs (Board of Studies 2000b). In the early and middle years (Years P-8), integration of ICT was encouraged, while in the later years (Years 9-10), ICT was a specialist study area (Board of Studies 2000b).

The Victorian Government began questioning the efficiency of the CSF curriculum; both CSF frameworks lacked some key competencies. They were deemed ‘too prescriptive,’ having gaps between year levels, lacked attention to general skills, viewed the KLAs separately, and were reported as too rigid by teachers (DET 2003; VCAA 2004; 2014a). Additionally, they failed to engage students, resulted in higher absenteeism among middle school students and lacked
the ability to equip students with the necessary skills, attributes and knowledge to operate in the global economy (DET 2003; VCAA 2004; 2014a). Improvements were required and an alternate curriculum needed (DET 2003; VCAA 2004).

2.2.1.3: Victorian Essential Learning, 2006 – 2012

The design of the ‘Victorian Essential Learning Standards (VELS)’, introduced from 2006, was to overcome the shortfalls of the CSFII, to align with other Australian educational frameworks, and to bring students into the 21st Century (VCAA n.d.a; VCAA n.d.b). Upon full implementation of VELS, the CSFII became a reference document (Christophersen 2005). VELS comprised of a new format with three cross-curricular strands (Appendix B.3). VELS allowed individual schools the flexibility to tailor programs to meet the needs of their students, to specify and deliver a focused curriculum, and it enabled students to apply methods and knowledge learnt in one domain to other domains (MCEETYA 2008; VCAA 2007).

The ICT domain in VELS sits within the ‘Interdisciplinary Learning’ strand. This strand identifies the behaviours, skills, and knowledge that were applicable to other domains and prepare students to be creative, productive and competent (Curriculum Corporation 2006; VCAA 2008). A focus of interdisciplinary learning was to supply students with the tools to enrich and transform their learning (VCAA 2008).


Commencing from 2013 an Australian national curriculum, the ‘Australian Curriculum’ (AC) began its first stage of implementation. The main benefits of a national curriculum are equality of curriculum standards across the states and territories, avoiding duplication of resources, providing consistency for students and their families who move interstate, and leading to higher student achievements (Drabsch 2013; VCAA 2014a). During the implementation years of 2013 to 2016, Victoria introduced the ‘Australian Curriculum in Victoria (AusVELS)’ (ACARA n.d.b). AusVELS continued the ‘discipline-based approach to learning’ set out in previous frameworks by continuing the Learning Levels structure, rather than adopting the Year Levels set by the AC (VCAA 2014a, p. 12).
Incorporating the single AusVELS framework eradicated the need for schools and teachers to juggle two separate frameworks (ACARA n.d.; VCAA 2012; 2014a). AusVELS (Appendix B.4) amalgamated part of the AC with the existing Victorian educational approach, VELS, with individual schools maintaining and increasing their degree of curriculum individualism and flexibility (VCAA 2012; 2014a). However, by taking a more decentralised approach, concerns exist over the large differences in educational programs and teaching quality (VCAA 2014a). Victorian schools continued to utilise the VELS ICT domain throughout the AusVELS years. AusVELS could be utilised up to the end of 2016 (ACARA n.d.b).

2.2.1.5: The Australian National and The Victorian Curriculum F-10, 2016 -

The AC curriculum (Appendix B.5) is a requirement of all Australian Government and Catholic schools, and a resource and model for Independent schools (ACARA n.d.c; Independent Schools Victoria n.d.). Students in all year levels are educated using the same common curriculum base while continuing to allow content flexibility for individual schools, states and territories (ACARA n.d.c; National Curriculum Board 2009; VCAA 2012). Each individual school sector and their curriculum authorising body within Australia determine their implementation schedule for the AC, it is anticipated that full implementation to all school students would occur by 2020 (Queensland Teachers Union 2015).

In Victoria the AC curriculum, known as the ‘Victorian Curriculum F-10’, reflects upon and includes most of the AC; differences are the addition of continued learning progressions throughout the learning year levels, and the amalgamation of the three general capabilities, Literacy, Numeracy, and ICT Capability, into all other learning areas (ACARA n.d.c). Incorporating areas in this way indicates that it is the responsibility of all teachers to instruct students in ICT, Literacy and Numeracy (Australian Council for Computers in Education [ACCE] 2015). During 2016, schools could commence using the Victorian Curriculum for F-10 students or continue with AusVELS, although by the beginning of 2017 all Victorian government and Catholic schools will need to implement the Victorian Curriculum F-10 (ACARA n.d.b; n.d.c). The Victorian Curriculum details ICT as both an integrated area for all students, and an elective area for middle secondary students (Appendix B.6) (ACARA 2012b). The autonomy given to schools
enables them to either embed ICT and/or teach it individually (ACARA 2012b).

2.2.1.6: Working Toward the National Curriculum

The notion of a national curriculum is not a recent one. Several attempts to ‘construct a common national curriculum’ occurred from 1968 (Yates & Collins 2008, p. 8); although these initial attempts failed, the idea of a national curriculum had begun (Drabsch 2013; Stephenson et al. 1998). During inaugural discussions for a national curriculum, political issues between the States and Territories hindered the process, although after supplemental discussions and investigations into other Australian curricula, an agreement was finalised in 1989 on the implementation of a national curriculum, the formation of KLAs, and national educational goals (Marsh 1994; MCEETYA 2008; Yates & Collins 2008; VCAA 2004). The final commitment came in 2009 when the governments of all Australian States, Territories, and the Commonwealth agreed upon a national education system, with the establishment of Australian Curriculum, Assessment and Reporting Authority as the national curriculum body (Drabsch 2013; VCAA 2014a).

In the lead up to incorporating a national curriculum, Victoria included several national goals in the development of its past curriculum frameworks (for example see Blackmore et al. 1996). The CSF, CSFII and VELS, were ‘useful stepping stones’ (VCAA 2004, p. 2) leading up to and aligning with national curriculum objectives (Drabsch 2013; VCAA 2014a). As with all subsequent curriculum implementations, there was an extensive validation process; this process includes thorough consultations, the release of curriculum drafts, testing of drafts, adjustments, revisions, and refinement before final publication and release for school use (National Curriculum Board 2009).

2.2.2: Post-Compulsory Learning Years Curriculum

Educational programs in the post-compulsory years are for senior students, usually aged 17 to 18, and studying education in Years 11 and 12 (Kosky 2002). By the 1980s, concerns existed over the retention rate of senior students with some students leaving school early due to unfulfilling experiences, and investigations began into initiatives to tackle this problem (Ministry of Education 1984; Ministerial Review of Postcompulsory Schooling 1985; State Board of
Consequently, in 1987 the Victorian Certificate of Education (VCE) replaced the existing Higher School Certificate. From 1993 vocational studies were also offered and then in 2003 a third certificate, Applied Learning, became available (see Sections 2.2.2.1, 2.2.2.2, & 2.2.2.3 below). The range of senior programs gave students a wider choice of study (Appendix C.1), increasing their education level, and improving future career and study prospects. To improve retention rates in Australia, students were legally required to continue studying until 17 years of age from the beginning of 2010 (ACARA 2010; State Government of Victoria 2009). In combination, these initiatives not only increased retention rates, they lengthened the time of compulsory education, encouraged completion of secondary education, and catered for a wider range of students and student abilities (ACARA 2010; NSW Auditor-General 2012; State Board of Education 1987).

2.2.2.1: Victorian Certificate of Education 1987 -

In 1985 a Victorian government report was released laying down the foundations for a two-year senior study course, the Victorian Certificate of Education (VCE), which was introduced in 1987, and is still in use today (Melbourne Graduate School of Education 2008; Ministerial Review of Postcompulsory Schooling 1985). The plan was for the VCE to contain a combination of common and specialist studies (State Board of Education 1987). When introduced, the VCE catered for Year 12 students only; by 1990 a two-year program had been developed and implemented for students in both Years 11 and 12 (Melbourne Graduate School of Education 2008; State Board of Education 1987). When the two-year VCE program was introduced, all prior senior computing subjects were replaced by a range of Information Technology (IT) subjects (Appendix C.2), this included the loss of Secretarial Studies and electronic typewriting that were directed at female students (Tatnall & Davey 2004). The offering and availability of IT studies were up to individual schools; their decision would require school council approval and included consideration of issues around equipment, teacher availability, timetabling, and student interest.
2.2.2.2: Vocational Education and Training 1993 -

In 1993 the Vocational Education and Training in Schools program (VETiS, commonly known as VET) was introduced; allowing senior students the option of gaining nationally recognised vocational qualifications other than the VCE (VCAA 2010a). Initially, VET studies were independent of the VCE, although a change made to the educational structure in the late 1990s allowed senior students to study VET certificates within the VCE (Appendix C.1) (VCAA 2010a). The VET program began in three areas and progressively expanded to include more than 30 areas with over 390 certificates on offer to senior students (VCAA 2010a; 2016). VET studies include the options of School-Based Apprenticeships and Traineeships and Further Education studies. School-based apprenticeships and traineeships include a combination of vocational training and part-time employment (VCAA 2011). Further Education includes adult education certificates accredited by the Australian Quality Training Framework (VCAA 2011). Computer related studies offered and studied within VET have changed over the years (Appendix C.3).

2.2.2.3: Certificates of Applied Learning 2003 -

The Victorian Certificate of Applied Learning (VCAL), introduced in 2003, provides students with numeracy and literacy skills, personal development, and work-related experiences that assist students in making choices in relation to further education and employment (VCAA 2011). The VCAL program is available at three levels, Foundation, Intermediate, and Senior. Students in Year 11 enrol into one of the first two levels, selecting whichever is better suited to their abilities, they then can continue to the following level in Year 12 (VCAA 2011). Students undertaking VCAL may study units from the VCE and VET. There are no specific ICT units in the VCAL program, although students can use computers to assist their learning and could choose to study ICT from VCE or VET.

2.2.2.4: Senior Secondary Studies in The Australian Curriculum 2016 -

The transition began toward the Australian / Victorian Curriculum senior studies in 2016. The range of senior secondary years’ subjects is progressively being developed; to date, fifteen subjects in four areas, English, Mathematics, Science,
and History and Geography have been created (Appendix C.4) (ACARA n.d.a). Implementation of the curriculum is up to the states and territories and their educational authorities (ACARA n.d.a). Eventually, each subject outline will describe its content, achievement standards, learning quality, skills, knowledge and understandings (ACARA n.d.a).

The Digital Technologies subjects for senior secondary students in the AC curriculum are yet to be developed. Early plans were to provide students with opportunities to be involved with project management, report planning, creating and testing designs, use of computational and algorithmic thinking, production of data to solve problems, using various analysis techniques, communicating, and working independently as well as in teams (ACARA 2012b).

2.3: Building a Modern ICT Education Infrastructure

Policy influences from multiple government levels impact on ICT in education from both within and outside of the educational field (Moyle 2010). State and Territorial governments are responsible for education, while the Australian Commonwealth government controls and provides financial assistance through legislative allocation (Moyle 2010). Australian and Victorian governments have initiated, mostly funded and implemented various ICT policies and initiatives throughout the last few decades to support ICT in education. These strategies were to assist in the improvement of ICT teaching, ICT access, ICT usage within education, and student preparation for the future. Funding and policy influences are not limited to governmental sources. Participants in ICT, and other associated industries have initiated and implemented enterprising undertakings. This thesis does not allow space to discuss them all; an outline of a selection of those highly relevant to this research are below.

2.3.1: National ICT Policies and Initiatives

This section presents national policies related to ICT in education and includes the National Network, The Digital Education Revolution, and aspects of Building the Education Revolution. Additionally, initiatives that assist schools and students with computer equipment access and a campaign to inform people of ICT careers follow.
2.3.1.1: The National Broadband Network

In order to provide a suitable national ICT network for all, the Australian Government invested heavily in the construction of the National Broadband Network (NBN). The NBN infrastructure, due to be fully completed by 2020, is expected to provide an Australia wide reliable high-speed broadband network available to all homes, businesses and schools through fibre-optic cables, fixed wireless or satellites (Department of Broadband, Communications and the Digital Economy [DBCDE] 2012a; 2012b; Salt 2015). Cable rollout began in 2010 and as areas become complete usage is available (DBCDE 2012a; State Government of Victoria 2010). In the educational sector, the NBN expects to take ‘education from the classroom to the world’ through information availability, virtual classrooms, video conferencing, and connections with specialists from around the world (DBCDE 2013).

During the first few years of the NBN rollout, the Australian Government contributed approximately $27 million over four years for the NBN-Enabled Education and Skills Services Program (DEEWR 2013a). The program began in July 2011, and authorised projects were to be completed by the end of 2014 (Australian Government 2012). The aims of the program were to use completed sections of the NBN infrastructure, to fund online educational project development and service trials, and to increase the education, skills, and training of Australian students, trainees, and learners, irrespective of where they lived, worked, or studied (Australian Government 2012; DEEWR 2013a). Recipients and providers of online education could be at any level from primary school upwards (DEEWR 2013a). Thirteen applications were ultimately successful (DEEWR 2013a). The funding allotted was in addition to any Digital Education Revolution funding (Australian Government 2012).

2.3.1.2: The Digital Education Revolution 2008-2013

The Digital Education Revolution (DER) aimed ‘to contribute sustainable and meaningful change to teaching and learning in Australian schools that will prepare students for further education, training and to live and work in a digital world’ (DEEWR n.d.e., pp. 12-13). The DER, approved from the end of 2007 to the middle of 2013, promised assisted development of ICT skills for the future, and
consisted of four components aimed to benefit schools, teachers, students and parents through improved infrastructure, provision of equipment, training, and resources (Dandol Partners 2013; DEEWR 2008a). Nationally, the Australian Government bestowed $2.4 billion for DER (Joint Committee of Public Accounts and Audit [JCPAA] 2011, p. 19).

Improvements to ICT infrastructure under DER funding consisted of the **National Schools Interoperability Program** (NSIP) that was established for all schools in 2010 (DEEWR n.d.a). The aim of the NSIP was to improve the operation, delivery, and access to digital learning products and services through shared resources and infrastructure across the educational sector in Australia, investing $100 million for high-speed broadband connections (The Auditor-General & DEEWR 2011; DEEWR n.d.a). The NSIP Program Office provided guidance about interoperability issues, shared resources and infrastructure, and knowledge sharing of current and previous projects (DEEWR n.d.a). The NSIP System Interoperability Framework (SIF) Association supported national and international SIF associations and maintained and developed SIF specifications in Australia (DEEWR n.d.a). The framework itself interconnected educational information systems with common technical standards that promised to reduce costs, improve services, and minimise system connections (DEEWR n.d.a). The work of the NSIP provided support and leadership to the DER (DEEWR n.d.a).

The DER initiative introduced the **National Secondary School Computer Fund** (NSSCF), the largest funded component of the DER, assigning around $1.4 billion from its funding for ICT equipment for schools (JCPAA 2011). The NSSCF was available to all schools that had students in Years 9 to 12 to assist with individual access to a computer while at school; computers purchased under this fund could be Desktop Computers, Laptops, Notebooks, Tablets or a combination of these (JCPAA 2011). The secondary schools that applied for funding were required to meet certain criteria with distributed funding based on a financial limit of $1,000 for individual computers and $1,500 for maintenance and installation (DEEWR 2011b; DEEWR n.d.e). Individual schools would make the decision on whether students could take portable computing devices home; homeschooled students were not eligible to apply under the NSSCF (DEEWR 2011b).

A national target of 786,000 computers was set at the commencement of the
NSSCF, by the middle of 2013 there had been 967,667 computers supplied, far exceeding the original target and showing commitment to reaching 1:1 computer access for older secondary students (Dandol 2013; DEEWR 2013b). Further positive aspects of the NSSCF were the ability for schools to purchase associated digital equipment due to bulk purchasing saving, students increased computer usage, motivation, interest and engagement in learning (Arthur 2013; The Auditor-General & DEEWR 2011). Research conducted by Crook, Sharma and Wilson (2015) indicated that Laptops benefitted students learning outcomes somewhat in secondary school senior Science subjects, although not to any great degree.

Initial NSSCF funding did not include all deployment costs, an extra $807 million added to the original NSSCF funding allocation was for item costs such as network equipment installation and maintenance, and training and support for technicians (The Auditor-General & DEEWR 2011; JCPAA 2011). Preceding this additional funding an Australian school authority had withdrawn its NSSCF application and support because of a need to meet ongoing costs (The Auditor-General & DEEWR 2011). Other problems with the NSSCF were some implementation oversights, schools preparation variance prior to purchase and installation, problems with infrastructure upgrading, the need for enhanced teacher training, and repair turnaround of Laptops (The Auditor-General & DEEWR 2011; Danks 2012). Danks (2012) commented that piles of thousands of broken Laptops and the provision of replacements, if available, could cause the DER to collapse, Federal and State governments were not committing to a continuance of funding. Keeping up 1:1 access became an issue, instances occurred where Year 12 students donated their devices to younger students when they left school (Danks 2012).

The training and resource aspects of the DER occurred through the *ICT Innovation Fund* (ICTIF). The ICTIF contained four projects that aimed to provide professional assistance through an online toolkit and to enhance the use of ICT in the classroom through improving the ICT proficiency of school leaders, in-service and pre-service teachers (DEEWR n.d.c). The aim of the ‘ICT in Everyday Learning: Online Toolkit’ project was to assist teachers and school leaders by providing current and new PD resources for incorporating ICT into the
classroom in line with the upcoming Australian Curriculum requirements of general capabilities and cross-curriculum perspectives (DEEWR n.d.d). The ‘Leading ICT Learning in Technology Enabled Schools’ project provided a networked portal with resources to prepare and assist school leaders in comprehending and achieving the possibilities that ICT brings to the learning environment (DEEWR n.d.b). The aim of the ‘Pathways for Learning Anywhere, Anytime; A Network for Educators (PLANE)’ project was to procure a professional learning online space that was available at any time (DEEWR n.d.f). PLANE supported teachers through a variety of resources and allowed teachers to take part in professional learning to achieve competence, track learning, gain experience, build confidence, and connect to others; all while concentrating on strengthening students’ use of ICT (DEEWR n.d.c; DEEWR n.d.f). Nationally, allocation of $40 million was for teacher ICT PD (The Auditor-General & DEEWR 2011; JCPAA 2011). The aim of ‘Teaching Teachers for the Future (TTF)’, the fourth project, was to train future teachers to ‘better utilise ICT in the classroom’ (DEEWR n.d.g). The TTF project comprised $8.8 million to improve the ICT proficiency of all graduating teachers in all Australian teacher-training higher education institutions (DEEWR n.d.g; Romeo, Lloyd & Downes 2012).

Implementing the TTF involved a complex process of institutional collaboration, rethinking the teaching of integrated ICT, tertiary teacher course redesign, building the ICT capability of teacher educators, developing and implementing integrated ICT capabilities into individual subject areas, and training pre-service teachers (Heck & Sweeney 2013; Masters, Carolan & Draaisma 2013; Zagami 2013). TTF also included the provision of resources through professional learning networks, such as PLANE, and providing access to ICT Pedagogy Officers (DEEWR n.d.g; Zagami 2013).

TTF research carried out by Heck and Sweeney (2013), Doyle and Reading (2013), and Finger et al. (2013) indicate that pre-service teachers altered their perceptions of ICT use in education through immersion in ICT activities, with their confidence significantly increasing in relation to their own use of ICT and in assisting students with ICT use after studying updated teacher courses. Nevertheless, Romeo, Lloyd and Downes (2013) believed that focusing on changing educators, teacher aptitude and building resources, among other issues
would require far more financial commitment than that prescribed.

The DER and its components were extremely successful in distributing computing equipment to schools and students in Years 9 to 12, building upon infrastructure and connectivity, collating a huge amount of digital resources, increasing technology use by teachers in the classroom and their ICT competence (Dandol 2013; Digital Education Advisory Group [DEAG] 2013). However, the time limit on the fund has expired and not been renewed. Some schools did not fully utilise devices, and more was required in the delivery of teacher ICT PD (Arthur 2013; Dandol 2013). Many schools have had to consider where future funding was to come from to keep up a 1:1 computers access target (Kelleher 2013). DER distributed equipment would now be outdated, with the cost of equipment now falling onto schools and student families. Arthur (2013) disclosed that not all promised infrastructure improvements were realised; some years after the announcement of the DER, construction of the NBN began. The NBN network is to overtake those infrastructure areas, promised under the DER but not completed, but until the NBN is fully completed these will not come to the realisation (Arthur 2013).

2.3.1.3: Building the Education Revolution 2008-2012

The Australian Government funded the Building the Education Revolution (BER) as part of the Nation Building Economic Stimulus Plan from 2008 to 2012 for both government and non-government schools at a total cost of $16.2 billion (DEEWR 2011a). The main aim of the BER was to supply upgraded and/or new school facilities and infrastructure to approved schools ‘to meet the needs of 21st Century students and teachers’ (DEEWR 2011a; n.d.e). One aspect of the BER focused on small-scale maintenance and minor capital works. Schools could apply for funding associated with ICT infrastructure installation in order ‘to make the building operational for the purpose for which it has been built’ (DEEWR 2011a, p. 8). The BER funding excluded any items and associated funding that was within the NSSCF (DEEWR 2011a).

2.3.1.4: Supplying Equipment for Schools and Students

Australian primary students can be supplied with low-cost Laptops, pre-loaded with educational software, through the not-for-profit organisation, One Laptop
Per Child Australia Project (OLPC) (Empowering children through education 2013; DEEWR 2013b). The OLPC project, founded in 2005 for worldwide application, began in Australia in 2009; it works with the DEEWR to provide equipment to children that need it most, empowering them to learn (Empowering children through education 2013). The DEEWR and OLPC hope to provide half a million Laptops to primary school students by 2020 (DEEWR 2013b). Recipients of OLPC Laptops in remote areas welcome them, they save school and family finances, are adaptable for each student, accept local Australian indigenous dialects, encourage responsibility, benefit the community, and foster greater attendance (Guest 2009).

Providing computer tools to students, irrespective of year level also occurs through the collection of surplus computer equipment from government departments, companies, businesses and private schools throughout Australia and dispensed on a needs basis. One such initiative is the Computer Technologies for Schools (CTFS) Project (DEEWR 2011b; 2013b). The CTFS has collected at least a quarter of a million surplus pieces of computing equipment since 1997 and distributed them to a mixture of public and private schools that had made requests for equipment (CTFS n.d.). The CTFS aims to provide greater access to ICT equipment in Australian schools, to improve teacher and student ICT access and to enable a further understanding of computing technology (CTFS n.d.). Similar initiatives operate in every state and territory of Australia by service clubs, not-for-profit and charity organisations. They collect donated working and non-working electronic items including computer equipment from individuals, organisations, small businesses and companies, for refurbishment, recycling, and redistribution (for example see PCs for Kids n.d.). Once processed, some equipment is put up for sale at a low cost, while other items are given free to those who meet certain criteria, particularly for use by the aged, disadvantaged, and under-privileged. Recipients include residents on mainland Australia and surrounding islands, with excess equipment shipped to developing countries and other overseas destinations yearly (for example see Rotary Club Nundah 2016).

2.3.1.5: Bring Your Own Device

Over the last few years, an increasing number of schools have followed the national and international tendency to allow students to bring their own
computing device to school for educational purposes (Ricci 2015; Stavert 2013). Terms such as Bring Your Own Device (BYOD), Bring Your Own Technology, and Bring Your Own Laptop describe this initiative (Johnson & Saylor 2013; Softlink 2014; Stavert 2013).

BYOD is not a simple as just taking any computing device to school, there are policies and documentation to create, teachers to train, maintenance responsibilities and school culture to consider (Johnson & Saylor 2013; Ricci 2015; Stavert 2013). Australian schools are individually responsible for their own BYOD policies, guidelines, and practices; therefore, these alter from one school to the next and large differences exist (Ricci 2015). Some schools dictate preferred suppliers and/or particular devices for parents to purchase, some bulk purchase and sell on, while others provide a list of acceptable specifics or devices (Lee 2015; Ricci 2015; Stavert 2013). The extent of acceptable BYOD use also varies between schools; some schools fully encourage students to use their own devices anywhere within the school, some only outside of the classroom, while others do not allow any BYOD use (Softlink 2014). Stavert (2013) indicated that some students are beginning to put pressure on their schools to allow the use of their own devices at school.

The reasons why schools are considering, or have introduced BYOD are financial, access to devices, and familiarity (Ricci 2015). Stavert (2013, p. 5) reported that the ending of government funding gave schools ‘serious consideration’ to contemplate BYOD as a viable and alternative strategy. The cessation of the DER, and its NSSSF funding brought about the issue for schools to maintain a 1:1 access ratio (Ricci 2015; Stavert 2013). For example, research carried out by Janssen and Phillipson (2015) reported that after the conclusion of the DER NSSSF funding approximately four out of five sampled Victorian secondary schools continued to maintain 1:1 learning, with around 64% of the sample implementing an operational BYOD program.

Most schools would be unable to continue providing up-to-date technology. When incorporating BYOD, the cost of technology purchase shifts onto parents, however, many students may already have their own devices that may be superior to school computer equipment (Lee 2015; Ricci 2015). Even with a BYOD program in place, schools will need a financial commitment for technical support.
Additionally, charges for parents for infrastructure and support fees may still occur. However, BYOD could further disadvantage students from low socioeconomic households by increasing educational costs for those that can least afford them (DEAG 2013; Ricci 2015).

School provision of digital devices for student use at schools is decreasing while the ownership of students’ individually owned digital devices is increasing, this will contribute to BYOD in schools and meet the constant need for upgraded devices (DEAG 2013; Softlink 2014). Implementing BYOD initiatives increases student computer access and assists in overcoming technology shortages in schools, through giving other students without BYOD devices greater access to school devices, while keeping up-to-date with technology development (Johnson & Saylor 2013; Ricci 2015; Stavert 2013).

Authors argue that students who use their own devices at school are more comfortable and familiar with them, require less training, and are more likely to complete homework, participate in class and take better care of the device, while being able to store their work in a single place (Johnson & Saylor 2013; Ricci 2015; Stavert 2013). However, there are concerns that students are more distracted and tempted to occupy themselves with non-school work such as games while using their own device (Ricci 2015).

2.3.1.6: Informing ICT Careers

To promote ICT career awareness, encourage and inspire the development of ICT skills, the ICT: Start Here. Go Anywhere campaign is part of the annual National ICT Careers Week (Department of State Development, Business and Innovation [DSDBI] n.d.; State Government of Victoria 2010). The campaign, sponsored by ICT Industry representatives and the Victorian Government, was initially held in 2007 in Queensland and adopted nationally the following year (Department of Education, Training and Employment 2007; State Government of Victoria 2010). The aims of ICT: Start Here. Go Anywhere are to improve the perceptions of young people in relation to ICT careers and study options (State Government of Victoria 2010). The ICT Careers Week is open to students, parents, teachers and other interested people to explore opportunities in ICT (DSDBI n.d.).
2.3.2: Victorian ICT Policies and Initiatives

Accompanying the national initiatives described above are some that relate particularly to the Victorian state. The Victorian Government has financially contributed to infrastructure, equipment allocations, support and resources.

2.3.2.1: Infrastructure Improvements

The Victorian Government VicSmart initiative saw the construction of a secured network that interlinked all Victorian government schools, the Department of Education and Early Childhood Development (DEECD), and the Internet via fibre-optic cables (DEECD 2012b). The VicSmart project took place between October 2005 and December 2011 at an estimate of $89.3 million and installed by a single provider; it increased Internet speeds approximately sixty times, with the provided bandwidth size dependent upon each school’s size and location (DEECD 2012b; Victorian Auditor-General’s Office 2012). VicSmart contributed to an increased use and enhancement of digital learning, enabling students, teachers and administration staff to quickly access online materials, share knowledge, increase skills, use video-conferencing, undertake training, increase productivity, and store information centrally (DEECD 2012a; 2012c; Victorian Auditor-General’s Office 2012).

The Victorian Governments School Technology Architecture and Resources (eduSTAR) computer network consists of five policy components: a centralised Internet service provider (ISP), a software resource repository, online technician training, e-learning planning and ICT infrastructure (DEECD 2013a). The central ISP provides the Education Department’s electronic library and email service through the VicSmart network and the Internet (DEECD 2013a). The eduSTAR software catalogue contains over 80 resources with a mixture of software, applications, and tools for use within learning areas (DEECD 2010b). Government schools’ computer networks must comply with the education department requirements in order to use the eduSTAR framework (DEECD 2013a).

2.3.2.2: Teacher and Student Equipment

The State Government of Victoria Notebooks for Teachers and Principals Program, eduSTAR.NTP, provides eligible teachers and principals from
government schools with Notebook computers (Information Technology Division 2009; DEECD 2013b). The recipient of each Notebook was required to contribute financially towards the lease payment with each Notebook under lease for 3 to 4 years (DEECD 2013b; n.d.a). Prior to receipt, the recipient was required to agree to terms and conditions, such as acceptable use and e-learning professional development (Information Technology Division 2009). The aims of this program were to encourage and support recipients with the use of Notebooks for administrative purposes, PD, curriculum development and delivery, and the integration of ICT into teaching (Information Technology Division 2009; DEECD 2013b). The program, originally beginning in 1998, has provided 41,000 Notebooks since 2012 for teachers and principals (DET 2016a).

However, four and a half years after the inception of the eduSTAR.NTP program the Victorian Branch of the Australian Education Union won its case in the Federal Court against the deductions (Australian Education Union Victoria Branch [AEUV] 2015; Dinham 2015; Jacks 2015). The Federal Court ruled that it was illegal and unlawful under the Fair Work Act for the Victorian State Government to charge principals and teachers for the lease of digital devices that were an essential and necessary piece of equipment required to perform their job and not used for teachers’ individual benefit (AEUV 2015; Dinham 2015; Longbottom 2015; Jacks 2015). Most of Victoria’s 50,000 principals and teachers from government schools, who partook in the non-optinal and non-taxable deductible Laptop lease arrangements, would be entitled to receive interest and back payment for deductions. Estimates of these payments total more than 20 million dollars (AEUV 2015; Dinham 2015; Longbottom 2015; Jacks 2015). Longbottom (2015) stated that this case opens up the option for the other Australian States with similar teacher leases for digital devices.

A New Teacher and Principal Notebook Program (NTPP) began in 2016. These Notebooks are free and include insurance cover with no excess payments on claims (DET 2016a). The Notebooks assigned under the NTPP remain an asset of the appointed school; the school distributes them to teachers and principals for both school and personal use (DET 2016a). Teachers and principals need to meet particular criteria to be eligible for a Notebook with priority provided to recently graduated teachers (DET 2016a). The Victorian Government is investing $75.5
million over the next 4 years in the program (DET 2016a).

The Netbook Project trial was a Victorian Government initiative in 2009 and 2010 for 10,000 primary school children from 340 government schools in the Western half of Victoria to have computer access (DEECD 2009; 2010a; Griffin et al. 2010; State of Victoria & DEECD 2009). The trial aimed ‘to determine how computers can best support student learning’ (State of Victoria & DEECD 2009, p. 4). The small sized portable Netbooks were lightweight, loaded with educational software, wireless enabled, cheap to lease, and provided with technical support through the school (State of Victoria & DEECD 2009; DEECD n.d.c). Parents of students in selected year levels at the schools who had agreed to take part in the trial could lease the Netbook for the year at $52 and students were then able to use the Netbooks offline and at home (State of Victoria & DEECD 2009; DEECD n.d.d). The Netbook program trial contributed to the Victorian government reaching a 1:1 computer ratio in schools (DEECD n.d.c).

2.3.2.3: Technical Support

Technical support provided to government schools are through the Technical Support to Schools Program (TSSP), School ICT Progression Strategy, and eduSTAR components. The TSSP provides specialist technical support and funding to schools based on student numbers and support to build and maintain schools networks, for equipment and software (including teachers and principals’ Notebooks), and to render PD sessions (DEECD n.d.b). The School ICT Progression Strategy is part of the TSSP policy and enables further technical support for school’s ICT infrastructures (DEEWR 2009). Access to TSSP is via the VicSmart network (DEECD n.d.b).

2.3.2.4: Resource Availability

The Victorian Department of Education and Training assists the delivery of digital education by providing teachers and principals with online resources. The available resources cover a range of digital topics including school ICT planning, the curriculum, being a trustworthy user, equipment purchasing information, support, professional learning, and access to online local, national and international educational resources, video conferencing and educational software (DET 2015a).
The Ultranet, valued at $60.5 million and implemented in 2010, for Victorian Government schools was a multi-purpose state-wide ICT system and digital learning platform for school communities accessible via the Internet (DEECD 2010a; Victorian Auditor-General’s Office 2012). The Ultranet’s main aims were to provide a secure environment where students, teachers and parents were able to connect with each other, where knowledge transfer, resources and information were shared, and where students’ work can be showcased (DEECD 2010a; DEEWR 2009). Other aims were to improve educational outcomes and opportunities for all government school students and to reduce educational costs and workloads on school leaders and teachers (DEEWR 2009).

The Ultranet was termed a disaster and closed down by the Victorian Government at the end of 2013 after a $180 million outlay (LeMay 2014). Sale of the Ultranet occurred after termination and given a new name by its new owners, it again offered to schools; however, schools would have to pay if they wished to use it (LeMay 2014; Topsfield 2013). Reasons for the Ultranet’s demise were reported as poor implementation, not delivering promised benefits, reduced functionality, over budget, late delivery, poorly planned, afflicted with problems, little returns, low uptake and underutilised (Tomazin 2014; Topsfield 2013; Victorian Auditor-General’s Office 2012).

2.4: ICT Outcomes for Victorian Students’
Student data for this section was drawn from a number of sources including:

- The National Assessment Program (NAP) ICT Literacy proficient students and their usage and opinions,
- The successful completions of senior students VCE IT units and enrolments in VET IT courses, and
- Tertiary student enrolment numbers in IT studies.

Primary and secondary students up to and including Year 11 (VCE Units 1 and 2), VET and tertiary students are assessed by their classroom teachers or instructors. Obtaining these results was virtually impossible; instead, the adoption of nationally published NAP results and student enrolment numbers prevail. Assessment of VCE Units 3 and 4 (Year 12) are through a combination of school-
based coursework, assessed by their teachers, and examinations by externally appointed markers (VCAA 2011).

2.4.1: The National Assessment Program

The Australian Education Department performs NAP testing at strategic levels of students’ educational development, including a triennial test for Information and Communication Technology Literacy (NAP – ICTL) for students at Years 6 and 10. Additionally, NAP – ICTL information on student ICT use and interest in ICT is included.

The first round of NAP - ICT Literacy began in 2005 with assessors setting up a temporary mini computer lab of networked Laptops at schools (MCEETYA 2007). In 2008, school-based computers were connected to either a local or remote server, with mini-labs utilised as needed (MCEETYA 2010). In 2011, a USB stick contained the testing procedure (ACARA 2012a), while in 2014, testing occurred through an online system (ACARA 2015b). Trials of online NAP testing began in 2016 for other test areas, and from 2017 all testing will progressively move to a computer-based format (ACARA 2015c).

2.4.1.1: Victorian Student ICTL Proficiency Outcomes

Assessment for NAP - ICTL evaluates students’ on their ICT Literacy skills, and focuses on use, skill development, creativity, and confidence (ACARA 2012a). Educational authorities established six proficiency NAP - ICTL levels thought to be reasonable, although challenging, for students, the expectation is for Year 6 students to achieve proficiency level 2 and Year 10 students, level 3 (MCEETYA 2007). Table 2.2 displays the percentage of Victorian and the average for Australian students who met the minimum proficiency standard for their year level (ACARA 2015b).
<table>
<thead>
<tr>
<th>Class</th>
<th>2005</th>
<th>2008</th>
<th>2011</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 6</td>
<td>58% (49%)</td>
<td>66% (57%)</td>
<td>64% (62%)</td>
<td>64% (55%)</td>
</tr>
<tr>
<td>Year 10</td>
<td>67% (61%)</td>
<td>70% (66%)</td>
<td>68% (64%)</td>
<td>55% (52%)</td>
</tr>
</tbody>
</table>

Table 2.2: Percentage of Victorian (Australia) students at or above their NAP - ICTL proficiency levels

The results show that though Victorian Students fair better than the Australian average; many were not meeting the set proficiency level. Assessment results indicated an initial increase in achievement of proficiency levels followed by decreases. In the latest round of testing in 2014, Year 6 students have shown no improvement; while Year 10 students, recorded their lowest level since testing began (Table 2.2).

Victorian results for Year 8 students from an international study, the International Computer and Information Literacy Study (ICILS), conducted in 2013, indicated similar ICT Literacy results. When plotting Year 8 students ICT Literacy results with those of NAP – ICTL these students lie on the expected continuum from Year 6 to Year 10 results (De Bortoli et al. 2014). However, student improvement in achievement scores for ICT Literacy in the ICILS indicated that the rate of improvement between Years 6 and 8 was twice that of between Years 8 to 10 (De Bortoli et al. 2014). Year 8 students indicated that they were not too certain when it came to advanced ICT skills, but were very confident at achieving basic computing skills (De Bortoli et al. 2014).

2.4.1.2: Victorian Student ICT Usage

The NAP - ICTL assessment instrument included questions on student use of and access to ICT tools. Year 6 and Year 10 students’ use of computers at school has at least doubled, while home use has reduced since 2011 (Table 2.3). Students in Year 10 have shown increased use of computers for more than five years, while students in Year 6 use remain almost consistent (Table 2.3) (ACARA 2012a; 2015b; MCEETYA 2007; 2010).
Table 2.3: Computer usage by Victorian students in Years 6 and 10

<table>
<thead>
<tr>
<th>Year Level</th>
<th>Year</th>
<th>Computer used &gt; than 5 years</th>
<th>Frequency of computer use Usage (Mean days per month)</th>
<th>Used almost every day or more</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>At Home</td>
<td>At School</td>
</tr>
<tr>
<td>6</td>
<td>2005</td>
<td>60%</td>
<td>13.4</td>
<td>10.4</td>
</tr>
<tr>
<td></td>
<td>2008</td>
<td>64%</td>
<td>18.7</td>
<td>14.3</td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>70%</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>66%</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>10</td>
<td>2005</td>
<td>70%</td>
<td>15.6</td>
<td>11.6</td>
</tr>
<tr>
<td></td>
<td>2008</td>
<td>71%</td>
<td>23.0</td>
<td>13.7</td>
</tr>
<tr>
<td></td>
<td>2011</td>
<td>79%</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>85%</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Additionally, the ICILS indicated that four out of five Victorian Year 8 students had computer exposure for greater than five years, with 89% using computers at least weekly at home and at school (De Bortoli et al. 2014). Similarly, increasingly high usage patterns and length of time of computer usage by 15-year-old (Year 9) Australian students were reported by the OECDs Programme for International Student Assessment (PISA) series of three yearly assessments since 2000 (McLachlan, Craig, Coldwell-Neilson 2016; OECD 2015).

2.4.1.3: NAP Victorian Student Attitude and Interest in ICT

The NAP - ICTL test section on attitudes and interest included questions relating to importance, fun, and interest in technology. Presentation of data for 2005 and 2008 was different from 2011 and 2014: in 2005; calculation of averages by gender occurred (and further averaged for all tested students for use in the below table); in 2008, findings were an average over combined Year levels. Table 2.4 provides the percentage of students who replied as agreeing to and strongly agreeing to the computer attitude statements presented (ACARA 2012a; 2015b; MCEETYA 2007; 2010). Students generally have positive attitudes towards using computers. Students over the years now see computers slightly less important to work with than when testing began and view computers fun to use for work or play. However, student interest in technology is waning; interest in technology has dropped based on a decade ago, with older students continually less interested
in technology than younger ones.

<table>
<thead>
<tr>
<th>Year</th>
<th>Year Level</th>
<th>It is very important to work with computers</th>
<th>Work or play with computers is fun</th>
<th>I use computers because I feel interested in technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>6</td>
<td>85%</td>
<td>96%</td>
<td>80%</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>86%</td>
<td>88%</td>
<td>70%</td>
</tr>
<tr>
<td>2008</td>
<td>6 &amp; 10</td>
<td>84%</td>
<td>92%</td>
<td>53%</td>
</tr>
<tr>
<td>2011</td>
<td>6</td>
<td>81%</td>
<td>95%</td>
<td>65%</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>80%</td>
<td>91%</td>
<td>59%</td>
</tr>
<tr>
<td>2014</td>
<td>6</td>
<td>77%</td>
<td>92%</td>
<td>65%</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>79%</td>
<td>87%</td>
<td>58%</td>
</tr>
</tbody>
</table>

Table 2.4: NAP - ICTL Victorian student attitudes towards computing

Victorian students who undertook the ICILS and PISA tests answered the same computing attitude questions as in Table 2.4. Year 8 Victorian students in 2013 (ICILS) indicated higher agreement when answering the questions with 88%, 93%, and 65% respectively (De Bortoli et al. 2014). Older Year 9 Victorian students (PISA) mostly agreed with the importance of working with computers, and that computers were fun for work or play; however, by 2009 interest in technology was decreasing (Table 2.5) (McLachlan, Craig, Coldwell-Neilson 2016; OECD 2015).

<table>
<thead>
<tr>
<th>Year</th>
<th>It is very important to work with computers</th>
<th>Work or play with computers is fun</th>
<th>I use computers because I feel interested in technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>70.5%</td>
<td>81.1%</td>
<td>64.3%</td>
</tr>
<tr>
<td>2003</td>
<td>83.1%</td>
<td>84.2%</td>
<td>70.8%</td>
</tr>
<tr>
<td>2009</td>
<td>74.7%</td>
<td>81.3%</td>
<td>45.0%</td>
</tr>
</tbody>
</table>

Table 2.5: PISA Year 9 Victorian students’ computer attitudes

2.4.1.4: Views of NAP Testing and Results

Teachers had little regard for the precursor to NAP, the Learning Assessment
Program; they viewed it negatively, were resistant to it, and thought it undermined their professionalism and affected classroom teaching and educational practices (Blackmore et al. 1996). Similar views hold today in relation to NAP testing, the Government produced NAP reports seem to focus on reporting in a neutral or positive way, and tend to downplay negative or reversing trends. In contrast, Dreher (2009) indicates that NAP is ‘promoted as a valuable method for improving learning outcomes and measuring student achievement and teacher accountability’ although she terms it as a ‘one size fits all’ philosophy.

Implementing, analysing, and reporting results of the NAP tests cost the taxpayers of Australia a massive $100 million (Coulson 2015). The Dulfer, Polesel and Rice (2012) report on educators’ perspectives on NAP literacy and numeracy testing debates its usefulness and accountability, questions its educational value, if any at all, and contests its use as a diagnostic tool. Some schools use results to change the way they teach, while outsiders and prospective parents use them to judge the schools, students and teachers (Coulson 2015; Dreher 2009; Dulfer, Polesel & Rice 2012).

The NAP test was said to be biased in favour of written skills, it was said to have increased teachers’ workloads, allowed schools and teachers to focus on test areas while other subjects suffered, influenced teacher independence negatively, ignored differences between schools, their environment and teaching practices and quality, and as a result does not give a full picture (Coulson 2015; Dreher 2009; Dulfer, Polesel & Rice 2012). Often schools run multiple practice sessions for students to improve results and to reduce student anxiety about the testing procedure (Dulfer, Polesel & Rice 2012). Students have been known to suffer physical and emotional side-effects such as stress, inadequacy, fear, crying, sleeplessness, and vomiting, or remain absent on test days, and teachers feel under pressure to improve student scores (Coulson 2015; Dulfer, Polesel & Rice 2012).

These comments relate to NAP literacy and numeracy tests and may well apply to ICT NAP testing as Phillips (2015) describes that decreasing NAP-ICTL results in schools indicates that ICT was failing our students and that instead of skills increasing with ubiquitous computing use they were decreasing (McLachlan, Craig, Coldwell-Neilson 2016). Phillips (2015) details that new curricula take the time to be fully implemented, teachers lack skills and professional support, too
many technological tools exist to choose from, and curriculum content and teacher skills become outdated quickly. Phillips (2015) continues that our schools lack appropriate equipment and appointments to deal with digital education.

ACARAs Chief Executive Officer, Mr Robert Randall, called for a ‘renewed focus’ in relation to declining achievements in school computing, and for schools to collaborate with each other and with ACARA to ‘turn this around because this is an important area’ (ACARA 2015a; Ford 2015). Mr Randall said that though students were ‘prolific users’ they may not be ‘proficient users’, and that ‘explicit teaching’ was necessary for students to achieve ‘deeper knowledge and understanding’ (Ford 2015).

2.4.2: IT Outcomes for Senior Secondary Students

Senior secondary options that contain studies in IT/ICT related areas are included in the VCE and VET programs. This section discusses the number of students undertaking this area of study for at least the last fifteen years.

2.4.2.1: VCE Satisfactory Completions

The number of students who have elected to study VCE IT subjects and successfully completed them increased from the year 1995 to around 2000. Christophersen (2001, p. 44) described the increase in all VCE IT units from 1992 to 1999 as a ‘strong and sustained growth’. Although, since 2000 a steady decline has occurred right up to the last few years, with numbers only recently starting to rise (Table 2.6) (VCAA 2016).

Meanwhile, the number of students undertaking and satisfactorily completing VCE has wavered between 47 and 50 thousand, with the lowest recorded in 2001 and highest in 2010 (Table 2.6). Numbers indicate that more students study VCE IT units when there are less VCE students overall and vice versa. Lighter shading in the table indicates the lowest numbers while the darker shading indicates the highest numbers in each column.
## Computing subjects available to VCE students

<table>
<thead>
<tr>
<th>Year</th>
<th>IT Unit 1</th>
<th>IT Unit 2</th>
<th>IPM/ITA 3</th>
<th>IPM/ITA 4</th>
<th>IS/SD Unit 3</th>
<th>IS/SD Unit 4</th>
<th>ITiS Unit 3</th>
<th>ITiS Unit 4</th>
<th>VCE’s attained</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>16439</td>
<td>16150</td>
<td>11252</td>
<td>10940</td>
<td>1551</td>
<td>1497</td>
<td>293</td>
<td>279</td>
<td>-</td>
</tr>
<tr>
<td>1996</td>
<td>17210</td>
<td>16420</td>
<td>11437</td>
<td>11100</td>
<td>1688</td>
<td>1598</td>
<td>209</td>
<td>202</td>
<td>47,347</td>
</tr>
<tr>
<td>1997</td>
<td>17969</td>
<td>17317</td>
<td>11597</td>
<td>11205</td>
<td>1883</td>
<td>1793</td>
<td>123</td>
<td>120</td>
<td>47,266</td>
</tr>
<tr>
<td>1998</td>
<td>19131</td>
<td>18468</td>
<td>12349</td>
<td>11948</td>
<td>1989</td>
<td>1900</td>
<td></td>
<td></td>
<td>47,450</td>
</tr>
<tr>
<td>1999</td>
<td>18609</td>
<td>18008</td>
<td>12769</td>
<td>12353</td>
<td>2186</td>
<td>2096</td>
<td></td>
<td></td>
<td>48,170</td>
</tr>
<tr>
<td>2000</td>
<td>18630</td>
<td>17817</td>
<td>13451</td>
<td>13076</td>
<td>2761</td>
<td>2677</td>
<td></td>
<td></td>
<td>48,869</td>
</tr>
<tr>
<td>2001</td>
<td>17119</td>
<td>16379</td>
<td>13344</td>
<td>12964</td>
<td>3346</td>
<td>3265</td>
<td></td>
<td></td>
<td>46,308</td>
</tr>
<tr>
<td>2002</td>
<td>15026</td>
<td>14415</td>
<td>11697</td>
<td>11373</td>
<td>3082</td>
<td>2975</td>
<td></td>
<td></td>
<td>48,561</td>
</tr>
<tr>
<td>2003</td>
<td>11948</td>
<td>11146</td>
<td>9774</td>
<td>9430</td>
<td>2842</td>
<td>2763</td>
<td></td>
<td></td>
<td>47,585</td>
</tr>
<tr>
<td>2004</td>
<td>9634</td>
<td>9332</td>
<td>7579</td>
<td>7316</td>
<td>2458</td>
<td>2398</td>
<td></td>
<td></td>
<td>48,134</td>
</tr>
<tr>
<td>2005</td>
<td>7967</td>
<td>7719</td>
<td>6350</td>
<td>6108</td>
<td>1988</td>
<td>1922</td>
<td></td>
<td></td>
<td>47,566</td>
</tr>
<tr>
<td>2006</td>
<td>6983</td>
<td>6878</td>
<td>5174</td>
<td>5027</td>
<td>1819</td>
<td>1771</td>
<td></td>
<td></td>
<td>48,352</td>
</tr>
<tr>
<td>2007</td>
<td>6508</td>
<td>6311</td>
<td>4516</td>
<td>4374</td>
<td>1500</td>
<td>1456</td>
<td></td>
<td></td>
<td>47,069</td>
</tr>
<tr>
<td>2008</td>
<td>6780</td>
<td>6210</td>
<td>3959</td>
<td>3850</td>
<td>1387</td>
<td>1345</td>
<td></td>
<td></td>
<td>49,073</td>
</tr>
<tr>
<td>2009</td>
<td>6352</td>
<td>6066</td>
<td>4089</td>
<td>3933</td>
<td>1304</td>
<td>1266</td>
<td></td>
<td></td>
<td>48,654</td>
</tr>
<tr>
<td>2010</td>
<td>5258</td>
<td>5171</td>
<td>3495</td>
<td>3381</td>
<td>1208</td>
<td>1179</td>
<td></td>
<td></td>
<td>50,057</td>
</tr>
<tr>
<td>2011</td>
<td>4624</td>
<td>4412</td>
<td>3107</td>
<td>3005</td>
<td>1304</td>
<td>1274</td>
<td></td>
<td></td>
<td>49,835</td>
</tr>
<tr>
<td>2012</td>
<td>4593</td>
<td>4494</td>
<td>2758</td>
<td>2659</td>
<td>1042</td>
<td>1021</td>
<td></td>
<td></td>
<td>49,724</td>
</tr>
<tr>
<td>2013</td>
<td>4304</td>
<td>4177</td>
<td>2595</td>
<td>2529</td>
<td>1335</td>
<td>1304</td>
<td></td>
<td></td>
<td>50,014</td>
</tr>
<tr>
<td>2014</td>
<td>4755</td>
<td>4484</td>
<td>2379</td>
<td>2323</td>
<td>1234</td>
<td>1212</td>
<td></td>
<td></td>
<td>49,262</td>
</tr>
<tr>
<td>2015</td>
<td>4592</td>
<td>4421</td>
<td>2569</td>
<td>2491</td>
<td>1351</td>
<td>1327</td>
<td></td>
<td></td>
<td>49,460</td>
</tr>
</tbody>
</table>

Table 2.6: VCE Information Technology satisfactory completions

Most VCE students who undertake IT studies find the subjects not difficult, with a high percentage of succeeding, and more students successfully completing VCE IT units than ever before. For example, in 1995, 83% of students had successfully completed Unit 1 IT, 86% in Unit 2 IT, 93% in Unit 3 of both Information Processing and Management (IPM) and Information Systems (IS), 95% in Unit 4 ITA, and 94% of Unit 4 SD. A slow, but gradual increase in successful completions has occurred to the present day. In 2015, successful completions amounted to 92% of Unit 1 IT, 93% of Unit 2 IT, 97% of Unit 3 IT Applications (ITA) and Software Development (SD), 98% for Unit 4 ITA, and close to 99% for Unit 4 SD (VCAA 2016). In 2006, IPM was revamped and named ITA, while IS...
became SD. The VCE subject of Information Technology in Society (ITiS) was withdrawn in 1998 due to low enrolment numbers (Christophersen 2001).

2.4.2.2: VET Enrolments

Throughout the last fifteen years, the number of students enrolling in VET IT certificates has almost halved, while the number of all VET enrolments have approximately tripled. The highest recorded year of VET IT students was in 2006, and the lowest in 2014, which was also the year of the most VET certificate enrolments. The proportion of VET students undertaking IT related certificates has constantly fallen since 2001. The proportion has remained under 5% since 2010, with only a minor increase in the last year (Table 2.7) (VCAA 2016).

<table>
<thead>
<tr>
<th>Year</th>
<th>VET IT certificate enrolments</th>
<th>All VET certificate enrolments</th>
<th>% IT of All VET enrolments</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>4409</td>
<td>24,685</td>
<td>17.8%</td>
</tr>
<tr>
<td>2002</td>
<td>4995</td>
<td>28,323</td>
<td>17.6%</td>
</tr>
<tr>
<td>2003</td>
<td>5374</td>
<td>37,685</td>
<td>14.3%</td>
</tr>
<tr>
<td>2004</td>
<td>5377</td>
<td>42,256</td>
<td>12.7%</td>
</tr>
<tr>
<td>2005</td>
<td>4807</td>
<td>47,363</td>
<td>10.1%</td>
</tr>
<tr>
<td>2006</td>
<td>5450</td>
<td>51,576</td>
<td>10.6%</td>
</tr>
<tr>
<td>2007</td>
<td>4573</td>
<td>55,249</td>
<td>8.3%</td>
</tr>
<tr>
<td>2008</td>
<td>3721</td>
<td>57,989</td>
<td>6.4%</td>
</tr>
<tr>
<td>2009</td>
<td>3369</td>
<td>60,776</td>
<td>5.5%</td>
</tr>
<tr>
<td>2010</td>
<td>2986</td>
<td>63,806</td>
<td>4.7%</td>
</tr>
<tr>
<td>2011</td>
<td>2901</td>
<td>67,048</td>
<td>4.3%</td>
</tr>
<tr>
<td>2012</td>
<td>3067</td>
<td>68,434</td>
<td>4.5%</td>
</tr>
<tr>
<td>2013</td>
<td>2328</td>
<td>68,463</td>
<td>3.4%</td>
</tr>
<tr>
<td>2014</td>
<td>2324</td>
<td>70,357</td>
<td>3.3%</td>
</tr>
<tr>
<td>2015</td>
<td>2558</td>
<td>68,470</td>
<td>3.7%</td>
</tr>
<tr>
<td>% change</td>
<td>-44%</td>
<td>+277%</td>
<td></td>
</tr>
</tbody>
</table>

Table 2.7: Vocational education and training Information Technology certificate enrolments

2.4.3: Tertiary Student Information Technology Studies

This section uses the higher education student enrolment statistics available
through the data search function, uCube (Department of Industry, Innovation Science Research and Tertiary Education [DIISRTE] n.d.). Table 2.8 shows the uCube data, filtered for the state of Victoria, the study area of Information Technology (IT), citizenship category (domestic, overseas), commencing name (commencing, continuing) and year, for Undergraduate and Post-Graduate students. Courses classified as IT include IT, Computer Science (CS), Information Systems (IS) and other IT. The statistics do not include those students studying IT as part of other tertiary courses or as a major field of study, or those studying at other post-secondary providers. Additionally, the data includes enrolled students, rather than completed students.

<table>
<thead>
<tr>
<th>Year</th>
<th>Domestic IT Students</th>
<th>Overseas IT Students</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Commencing</td>
<td>Continuing</td>
</tr>
<tr>
<td>2001</td>
<td>5,876</td>
<td>9,301</td>
</tr>
<tr>
<td>2002</td>
<td>5,156</td>
<td>10,140</td>
</tr>
<tr>
<td>2003</td>
<td>4,347</td>
<td>9,888</td>
</tr>
<tr>
<td>2004</td>
<td>3,611</td>
<td>9,244</td>
</tr>
<tr>
<td>2005</td>
<td>2,766</td>
<td>7,852</td>
</tr>
<tr>
<td>2006</td>
<td>2,556</td>
<td>6,428</td>
</tr>
<tr>
<td>2007</td>
<td>2,380</td>
<td>5,825</td>
</tr>
<tr>
<td>2008</td>
<td>2,149</td>
<td>5,074</td>
</tr>
<tr>
<td>2009</td>
<td>2,358</td>
<td>4,617</td>
</tr>
<tr>
<td>2010</td>
<td>2,402</td>
<td>4,642</td>
</tr>
<tr>
<td>2011</td>
<td>2,625</td>
<td>4,560</td>
</tr>
<tr>
<td>2012</td>
<td>2,850</td>
<td>4,571</td>
</tr>
<tr>
<td>2013</td>
<td>2,934</td>
<td>4,831</td>
</tr>
<tr>
<td>2014</td>
<td>3,331</td>
<td>5,079</td>
</tr>
</tbody>
</table>

Table 2.8: Victorian Tertiary Information Technology student enrolments

Table 2.8 shows that the number of enrolled Victorian tertiary domestic IT students decreased from the early 2000s to around the end of that decade. Numbers are slowly improving, although there were only just over half the number of domestic tertiary students studying IT in Victoria in 2014 than there were in 2002. Overseas students studying IT courses in Victoria have followed a
similar pattern, although, recent enrolment numbers are returning more quickly to previous highs. Consistently, since 2004 more overseas students were studying tertiary IT in Victoria than domestic students, thus possibly indicating that Victorian domestic students were less interested in IT than that of overseas students. Tertiary enrolments in IT are decreasing at a time when overall university student numbers are increasing (DIISRTE n.d.).

The previous sections have shown similar trends in the rising and lowering of senior and tertiary student enrolment numbers. Furthermore, in Australia, senior secondary IT subjects are not a prerequisite for entry into tertiary ICT courses (Lynch 2007; Tate 2012).

The demand for people with computing expertise has always outstripped the capacity of the tertiary sector to supply it, and the situation seems unlikely to change. (Pearcey 1988, p. 125).

Pearcey’s statement from the last century is still valid. Investigations into Victorian curriculum computing education are in a state of flux and fewer students undertaking such studies are disrupting the flow of the computing pipeline.

2.5: Teaching with Computers

2.5.1: Historical School Changes

After ‘decades of relative stability and the bureaucratisation of education,’ the self-management of schools changed the way they operated and put pressure on their communities (Blackmore et al. 1996, p. 195). Schools had to adjust quickly to educational, social and cultural restructuring; they were more competitive, had to change their practices and curriculum deployment, had greater responsibilities and accountability, changed student reporting practices and expectations, and ‘action preceded planning’ in the setting up of initiatives and activities (Blackmore et al. 1996, p. 200; Yates & Collins 2008). Curriculum and subject changes in curriculum frameworks introduced flexibility into education where a common set of standards, localised learning programs, and individual student progress were at the forefront (VCAA 2014a). However, introducing new curriculum statements incurred problems; some states adjusted subject profiles in the 1990s due to finding them unworkable and too complex for classroom application (Yates & Collins 2008). Additionally, many schools at this time were
under pressure of increasing student numbers when the government closed or combined approximately 600 schools in Victorian that had low enrolment (Blackmore et al. 1996). During this process, reduction of the teacher workforce by one-fifth occurred (Blackmore et al. 1996).

2.5.2: Investment Drawbacks

Australia’s heavy investment in computers in schools does not seem yet to have paid off. Much of the national and state government spending on improvements to infrastructure, connectivity, resources, support, training, equipment, and equipment access has had relatively short term influences, although long term positive effects are yet to be realised after the completion of the NBN. The number of dollars put into projects has not equated to increased student educational abilities in Mathematics, Science, Reading (OECD 2015), and ICT Literacy, or in more students undertaking ICT studies. Schools have had to find alternatives when government funding expired, placing more financial pressures on the school community and its members. Research has so far been inconclusive about the ultimate effect of technology use on students in education (Crook, Sharma & Wilson 2015; Sana, Weston & Cepeda 2013; Saavedra & Opfer 2012).

2.5.3: The Complexity Of and Changes In ICT in Education

The preceding sections demonstrate that the development of ICT in education in Australia has been an extremely complex and non-linear journey, it was certainly not as straightforward as providing students with devices. The development process was rapid, haphazard, and inconsistent, and has not even been able to keep up with the pace of technological change (Department of Employment, Education and Training [DEET] 1994; Pearcey 1988; Romeo, Lloyd & Downes 2013).

The introduction of technology has developed without planning. Those who pioneered the process were the early adopters, then there was a general rush to be involved. However, no one was in a position to know what was going on anywhere else. There was little thought to the outcome of circumstances where many ‘wheels’ were being invented (DEET 1994, p. 38).

Historically, ICT in education use ‘was poorly understood and mostly
unsuccessfully implemented’ (Romeo, Lloyd & Downes 2013, p. 3). Each subsequent curriculum framework release changed the placement of ICT and offered changes to the way that the ICT curriculum reaches students. Computing has gone from an elitist independent core subject to a combination of core and integrated subjects to a generalist integrated everyday subject taught within all school areas (see Section 2.2). In 2017, changes to ICT education are again upon us; it seems that ICT education is returning to a combined method of teaching, although the autonomy given to schools does suggest that differences will still exist with individualised curriculum designs.

Not only is it hard to keep up-to-date with the technology itself but the curriculum also has not kept up. Students and staff use words such as uninteresting, mundane, irrelevant, and repetitive to describe computing curricula in secondary schools (Craig 2006; Genrich, Toleman & Roberts 2014; Lynch 2007). While continuous ICT curriculum changes could indicate that authorities recognise the need to keep up with changes in society and technology, the time taken to develop new computing curriculum means it may well be already out-of-date when offered to students (McGill & Dixon 2003).

Recently noted obstacles to ICT in education includes equality of access, access to up-to-date equipment, increasing student interest, student and parent expectations, home computer and Internet access, regularity of computer use, teacher preparation time, resources, developing teacher knowledge, infrastructure, reliability of connectivity, school technical support, and influencing policies (De Bortoli 2014; Deloitte Access Economics & ACS 2015; OECD 2015).

2.5.4: Computing Equipment and Access

Computer equipment has changed considerably in a reasonably short space of time; moving from large room sized fixed mainframes to small portable lightweight Tablet computers. The decrease in computer size and an increase in numbers have altered student computer access. Access has improved from one computing device for many users to mostly a 1:1 situation. Australia is currently one of the top four countries for computer access and integration of computing in schools (OECD 2015). Interestingly a paradox exists where more is less; despite the wide use of ICT, fewer students study ICT (McLachlan Craig & Coldwell-
Neilson 2016; Pandel 2015).

Research shows that ICT enrolment numbers have been a concern for many years - a situation not restricted to Australia (Department of Finance and Administration & Australian Government Information Management Office 2007; Clayton 2007; Clayton & Lynch 2002; Craig 2009; Genrich, Toleman & Roberts 2014; Lang 2007; Lomerson & Pollacia 2006; Panko 2008; Van Der Vyver, Crabb & Lane 2004; Wilson & Avison 2007). In the recent past, lowering numbers have contributed to programs closures and fears that others may cease to operate (Christophersen 2001; Panko 2008; Wilson & Avison 2007). However, when offers of newer and advanced courses arise to encourage study at senior secondary school, there are not enough qualified teachers to teach them (Maio 2016).

2.5.5: Teachers that Teach Computing

Teacher use of ICT in the classroom has improved. Teachers in Western Australia had very high access to ICT devices (97%). In 2005 barely one-fifth (18%) regularly used them in teaching (Education and Accountability 2006), but by 2013, 85% were using ICT devices at least once a week when teaching (De Bortoli 2014). Computer use varies for different subjects; across Australia in 2013, teachers had very high usage of ICT devices in all subject areas, while students’ use was significantly less; however, students used ICT devices regularly at school 81% of the time (Table 2.9) (De Bortoli 2014). Australian teachers of Year 8 students reported high confidence in teaching computing tasks and stressed the importance of student ICT development across the curriculum (De Bortoli 2014). However, Australian teachers complained of insufficient preparation time to incorporate ICT into teaching, unsatisfactory technical support, inadequate connectivity, outdated equipment and lack of opportunities for skill development (De Bortoli 2014). There were reported incidences where teachers have taught ICT out of the book due to a lack of knowledge (Genrich, Toleman & Roberts 2014).
<table>
<thead>
<tr>
<th>Subject Area</th>
<th>Teacher Use</th>
<th>Student Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humanities</td>
<td>100%</td>
<td>42%</td>
</tr>
<tr>
<td>Science</td>
<td>99%</td>
<td>34%</td>
</tr>
<tr>
<td>ICT and related areas</td>
<td>98%</td>
<td>58%</td>
</tr>
<tr>
<td>Languages Other Than English</td>
<td>98%</td>
<td>24%</td>
</tr>
<tr>
<td>English</td>
<td>97%</td>
<td>34%</td>
</tr>
<tr>
<td>Mathematics</td>
<td>94%</td>
<td>23%</td>
</tr>
<tr>
<td>Creative Arts</td>
<td>89%</td>
<td>14%</td>
</tr>
</tbody>
</table>

Table 2.9: Percentages of computer use by Australia Year 8 teachers and students

In Australia, there are not enough ICT teachers to service the computing curriculum (Dodd & Parker 2014). Over the period of the three surveys conducted by the Australian Council of Educational Research (McKenzie et al. 2008; 2011; 2014), more primary teachers in 2013 than in 2007 had studied at least 1 semester of computing related studies and teaching methods in computing and/or IT at the tertiary level (Table 2.10). However, there were fewer primary teachers with more than five years’ experience in teaching computing and significantly fewer teachers currently teaching core computing (Table 2.10). These results show that even though fewer primary teachers teach core classes in computing and/or IT, more primary teachers were gaining skills to use in the generalised classroom. McKenzie et al. (2014) noted that almost 20% of primary teachers that had studied or trained in computing, and almost 16% in IT were not teaching these as core subjects.
A slightly higher percentage of secondary teachers had studied computing and/or IT and associated teaching methods at the tertiary level in 2013 than in 2007, but the increase in primary teachers qualified in computing/IT (Table 2.10) is outstripping secondary teachers (Table 2.11) (McKenzie et al. 2008; 2011; 2014). Table 2.11 shows that a very slight increase occurred in secondary teachers’ length of experience in teaching IT, although fewer secondary teachers had taught computing for more than five years. There was little or no increased change in the percentage of secondary teachers currently teaching specialised computing and/or IT in 2007 and 2010, however, a decrease occurred in 2013 (Table 2.11).

<table>
<thead>
<tr>
<th>Year Surveyed (number)</th>
<th>Computing</th>
<th>Information Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Study</td>
<td>Methods</td>
</tr>
<tr>
<td>2007 (5209)</td>
<td>11%</td>
<td>7%</td>
</tr>
<tr>
<td>2010 (4599)</td>
<td>34%</td>
<td>23%</td>
</tr>
<tr>
<td>2013 (5213)</td>
<td>33%</td>
<td>21%</td>
</tr>
</tbody>
</table>

Table 2.10: Percent of primary teachers with computing/IT qualifications

---

2 Key to tables 2.10, 2.11 and 2.12:

- no data available

- **Study** indicates at least 1 semester of tertiary study in computing and/or IT

- **Methods** indicated that the teacher had studies teaching methods in computing and/or IT at the tertiary level

- **>5 yrs exp** indicates that teachers had taught computing and/or IT for 5 years or more

- **Teach** indicates that teachers were teaching computing and/or IT when the survey was completed.
Table 2.11: Percentage of secondary teachers surveyed with computing/IT qualifications²

<table>
<thead>
<tr>
<th>Year Surveyed (number)</th>
<th>Computing</th>
<th>Information Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Study</td>
<td>Methods</td>
</tr>
<tr>
<td>2007 (5,394)</td>
<td>11%</td>
<td>6%</td>
</tr>
<tr>
<td>2010 (10,876)</td>
<td>17%</td>
<td>8%</td>
</tr>
<tr>
<td>2013 (10,349)</td>
<td>16%</td>
<td>8%</td>
</tr>
</tbody>
</table>

Table 2.12: Secondary ICT teachers with qualifications in IT²

<table>
<thead>
<tr>
<th>Year</th>
<th>Student Years Taught</th>
<th>Study</th>
<th>Methods</th>
<th>&gt;5 yrs exp</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>7 - 10</td>
<td>42%</td>
<td>26%</td>
<td>52%</td>
</tr>
<tr>
<td></td>
<td>11 - 12</td>
<td>60%</td>
<td>46%</td>
<td>60%</td>
</tr>
<tr>
<td>2010</td>
<td>7 - 10</td>
<td>53%</td>
<td>42%</td>
<td>46%</td>
</tr>
<tr>
<td></td>
<td>11 - 12</td>
<td>67%</td>
<td>52%</td>
<td>64%</td>
</tr>
<tr>
<td>2013</td>
<td>7 - 10</td>
<td>61%</td>
<td>46%</td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td>11 - 12</td>
<td>82%</td>
<td>62%</td>
<td>66%</td>
</tr>
</tbody>
</table>

The number of primary and secondary qualified teachers of computing and/or IT is increasing, although many students are taught by teachers who are teaching out of their field of expertise. Referring to Tables 2.10 and 2.11 the majority of teachers surveyed did not possess computing and/or IT qualifications, and Table 2.12 shows that many secondary students are taught computing and/or IT by unqualified or out-of-field teachers. This does not indicate that teachers have no experience or knowledge in the teaching of computing and/or IT, as teachers can gain skills after their tertiary education through teaching experience, PD, personal experience, and other informal ways.

For those secondary teachers teaching computing and/or IT as a core class, there
were increases in the number of teachers with qualifications in computing/IT study and teaching methods across the surveyed years (Table 2.12). Increases were also evident in the teaching experience of teachers of senior students, although there was little difference in the percentage of teachers of Years 7 to 10 who had more than five years’ experience (Table 2.12) (McKenzie et al. 2008; 2011; 2014). Males continue to make up the greater proportion of secondary computing and/or IT teachers at 60% in 2013; the only other subject with more male secondary teachers was Physics with 77% (Weldon 2015).

<table>
<thead>
<tr>
<th></th>
<th>Qualified study and methods and teaching</th>
<th>Not qualified either study or methods and teaching</th>
<th>Qualified study and methods and not teaching</th>
<th>Qualified study and not teaching</th>
<th>Qualified methods and not teaching</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computing</td>
<td>20%</td>
<td>7%</td>
<td>29%</td>
<td>24%</td>
<td>20%</td>
</tr>
<tr>
<td>IT</td>
<td>16%</td>
<td>9%</td>
<td>30%</td>
<td>24%</td>
<td>21%</td>
</tr>
</tbody>
</table>

Table 2.13: Qualified computing and/or IT secondary teachers teaching status in 2013

Weldon (2016) further analysed the 2013 survey data on teachers in Australian secondary schools (Table 2.13) and found that 75% of teachers with tertiary qualifications in computing/IT did not actually teach those subjects.

Varying reasons exist for teachers to be teaching out of their field of expertise; there are both school and teacher issues. Considerations from the school side are the school size, staff shortages and unfilled positions, timetabling of subjects, subjects offered, and class sizes (McKenzie et al. 2008; 2011; Weldon 2015; 2016). Schools are under pressure to obtain the best Year 12 results and often place the most experienced and competent teachers with senior students, leaving other teachers to fill positions and teach out of the field in lower secondary levels (Weldon 2015). Teacher issues include their teaching load, the teaching load of other suitably qualified teachers, qualifications to teach more than one subject, and the diversity of teaching with most primary teachers being generalists and secondary teachers’ specialists in particular subjects (McKenzie et al. 2008; 2011;
2.6: The Research Problem

A rapidly changing world constantly challenges the expectations of education systems, schools, teachers, teaching methods, and student learning requirements (Schleicher 2012). Digital advancements demand that students are more technologically able and comfortable with using ICTs (Deloitte Access Economics & ACS 2015; Schleicher 2012). Students are no more ICT literate now than they were a decade ago, although student experience and frequency of computer usage at school have increased dramatically. Additionally, fewer students elect to study computing at senior and tertiary levels despite the fact that now students learn computing throughout their primary and secondary years (Koppi et al. 2008). The lack of skill development in students occurs because schools and teachers no longer explicitly teaching these skills (Saavedra & Opfer 2012; Schleicher 2012). Results indicate that ICT Literacy should be a concern to educators and that the situation needs addressing.

Encouraging students to develop skills and undertake further ICT study requires knowledgeable, skilled, confident and competent teachers (Lang, Craig & Casey 2016). The integration of computing brought about the situation where almost all teachers teach computing concepts, although only a small number were qualified to do so (Tate 2012). The possession of strong technical knowledge and skills enable teachers to be effective in the classroom and to teach in interesting and engaging ways to improve student-learning outcomes (Deloitte Access Economics & ACS 2015; Schleicher 2012).

A growing need remains for the future of ICT literate students, teachers and workers. Developing quality teachers across the teacher-training spectrum to address and meet students learning needs is paramount (Lang, Craig & Casey 2016). Introducing new curricula, courses, or new aspects of computer education requires teachers to be trained prior to implementation, and for schools to provide teachers with support (Deloitte Access Economics & ACS 2015; Maio 2016). All teachers, including pre-service and newly qualified teachers, need support to advance their knowledge and implement their ideas (Lang, Craig & Casey 2016).

Introducing computing technology into education promised great changes,
however, to date this has not occurred, partly because of the deficit of opportunities for teachers to maximise the value of ICT tools (Saavedra & Opfer 2012). No matter how many or how new and technological capable computing devices happen to be, they do not, and cannot, replace great teaching or improve student learning on their own (DEAG 2013; Pandel 2015).

2.6.1: The Research Questions

Support for improving digital learning has increased exponentially, computing and computing tools have changed considerably, and the importance of computing defined in policies and the curriculum has increased. Therefore, the expectation is for good ICT outcomes for students. However, this does not appear to be the case. There are now fewer secondary and domestic tertiary students undertaking ICT studies.

ICT in Australian education has been in a continual state of flux since its introduction. Even in just the last few years, continuous curriculum changes have affected schools with teachers having problems keeping up, and with the curriculum failing to keep students interested. A reasonable assumption is that students’ ICT Literacy level is under the influence of how and what they are taught. Many students view computing study as not that important. One school in Sydney even reacted to this complex and confusing situation by reducing student reliance on ICT devices (Bita 2016).

Why low ICT Literacy and reduced interest in computer study still exists is unclear. Digital technologies are part of everyday life, yet students are unprepared for the digital economy. The question remains - what issues need to be resolved to improve students’ interest and outcomes in ICT? Continually changing circumstances place teachers and their teaching role, under pressure to broaden their skills and change their teaching practices (OECD 2005), teachers are now expected to know more, teach more, and to do more (Finger et al. 2007). However, what issues affect teachers in delivering ICT education to students and how prepared are teachers to do this?

Therefore the main research question is:

*How can teachers improve the factors affecting the successful teaching of ICT in schools?*
In order to address this multi-faceted question, the following underlying questions will assist in separating the details into smaller and more specific questions.

1. **What range of issues do ICT schoolteachers encounter in relation to ICT education?**

2. **Which inhibiting core factors affect Victorian ICT schoolteachers abilities in educating their students?**

3. **How does the first core factor influence teacher daily activities?**

4. **What experiences have schoolteachers encountered in managing the second core factor?**

5. **How do schoolteachers think they can improve their situation in the future in relation to these core factors?**

**2.7: Summary of Chapter 2**

This chapter described many facets of ICT in education in Australia including its historical, educational, political, and student involvement. The chapter has shown that ICT in education is complex and undergoes constant changes; however, students’ skills are not improving. The chapter concludes with the research problem and research questions. The following chapter describes the details of the underlying methodologies, methods and design of the research project conducted to address the research question.
Chapter 3: Research Methodology, Methods, and Design

The discussion of ICT in education provided in Chapter 2 established the need for a better understanding of the factors affecting the successful teaching of ICT in schools. Detailed research was required to investigate this further. In engaging in research, it is important that the approach is explicit and this chapter sets out to present and describe the research methodology, methods and design adopted to investigate these matters. According to Silverman (2005, p. 98) methodology can be defined as ‘a general approach to studying research topics’ and relates to the research problem and research questions, and the choices made about planning and conducting research. Research Methods are the specific techniques employed to conduct research (Remenyi et al. 1998; Silverman 2005). Methods detail how research should proceed, and are chosen based on the purpose of the research, the topic, the research questions, and data type required (Payne & Payne 2004; Punch 2005). A research method outlines how to manage the research whereas the research design details what you are going to do. The research design plans the execution that the researcher proposes to pursue while undertaking the research (Punch 2005; Remenyi et al. 1998; Williamson 2002). Punch (2005, p. 142) suggests the research design ‘situates the researcher in the empirical world’ in the overall planning and execution of the research. The research design includes the intended strategies, approaches, questions, samples, data collection, and data analysis methods used for the project.

Research questions guide the research and provide a link between the research problem, the data collected, and the research outcomes (Punch 2005). Research questions are required to be clear, specific, answerable, interconnected, and relevant; with a main general question followed by additional specific questions (Punch 2005). Specific research questions give the project ‘direction and coherence’, provide a framework, show the boundaries, and ‘point to the data’ needed for the research (Punch 2003, p. 29).

3.1: Methodological and Theoretical Grounding

Theories are the result of research outcomes that describe and explain a phenomenon’s concepts and their interactions, they are interpretive in nature,
summarise the past and guide the future (Evans, Gruba & Zobel 2011; Glaser & Strauss 1967; Punch 2005; Wallace 1974). Glaser and Strauss (1967) and Neuman (2011) interpreted theories as ‘not static’ (Neuman 2011, p. 56); that is, older theories are constantly modified and newer ones continually developed, such as those associated with the use of Grounded Theory.

Grounded Theory emanated from a quantitative exploratory study on secondary data by Glaser during his doctoral research years (Urquhart & Fernández 2006; Walsh et al. 2015). The first book on Grounded Theory, ‘The Discovery of Grounded Theory: Strategies for Qualitative Research’ was co-authored by Glaser and Strauss (1967). A dispute between these two authors occurred over coding strategies and processes in 1990, afterwards each developed his own version of Grounded Theory (Lyons & Coyle 2007; Urquhart 2013). Due to its flexibility, research trends, philosophical neutrality, multi-disciplinary nature, continual evolution, and the ability to use some or all aspects of Grounded Theory, many versions now exist (Charmaz 2014; Corbin & Strauss 2008; Denzin & Lincoln 2011; Glaser 1999; Lyons & Coyle 2007; Urquhart, Lehmann & Myers 2010; Walsh et al. 2015). Grounded Theory is an ‘adopt-and-adapt’ (Glaser 1999, p. 845) general method that is applicable to either quantitative or qualitative data types or both of them together, a variety of data sources and is independent of project size (Glaser & Strauss 1967). Urquhart, Lehmann and Myers (2010) classify Glaserian Grounded Theory as more open than the Straussian version; in Glaserian Grounded Theory, categories emerge from the data rather than being predetermined as in the Straussian interpretation. This project takes the original Glaser and Strauss approach, along with some of Glaser’s adaptations to Grounded Theory; and it incorporates further adaptions suited to this project’s particular situation.

Grounded Theory’s purposes are to create a theory, a model, or rich descriptions of a phenomenon based on data collected from participants’ views of processes, actions or interactions by comparing categorical incidences, integrating categories and focusing on dominant categories (Creswell 2007; Glaser & Strauss 1967; Patton 2002; Punch 2005; Urquhart 2013; Wiesche et al. 2017). According to Wiesche et al. 2017, a model uses some of the Grounded Theory components and does not attempt to explain relationships. A model can be a base to build a theory
upon, although further testing is required (Wiesche et al. 2017). Whereas, a theory makes use of the maximum number of Grounded Theory processes possible, develops core categories, and describes relationships (Wiesche et al. 2017).

Grounded Theory begins from the ground up, most often without an extant theory or proposed hypothesis (Glaser & Strauss 1967; Punch 2005; Urquhart, Lehmann & Myers 2010). Grounded Theory provides an opportunity to build an emerging theory, and verify it through further data collection, progressive focusing and from different views (Jones & Alony 2013; Urquhart 2013; Urquhart, Lehmann & Myers 2010). A very close link exists between data collection and analysis; these processes are concurrent, continuous, recursive and iterative while focusing the research and research questions throughout the process (Lyons & Coyle 2007; Urquhart, Lehmann & Myers 2010).

Grounded theorists often delay literature investigations to ensure the categories emerge from the data, Glaser and Strauss (1967) recommend postponing literature investigations on facts and theory of the study area until the core categories have emerged. Urquhart (2013, p. 29), and others, advocate the possibility of a pre-study non-committal literature review ‘to find the research problem’ (Chapter 2 in this thesis), and later follow with a second literature review (Chapter 6 in this thesis) once the study area is defined and emerging theory sufficiently developed. Fernández (2004) prefers one literature review conducted throughout the entire length of the project. Fernández (2004) depicts a process where coding, categories, and memos guide the literature review, and in turn, the literature review informs, refines, and relates the categories, therefore, resulting in a theory that contributes back to extant literature. Fernández (2004, p. 50) additionally reports that in his research a good deal of his readings was outside of the research’s main area; however, these ‘were made relevant by the actors’ main concerns and the emerging theory’.

Grounded Theory studies can be credible, original, resounding and useful (Charmaz 2014). The open-ended and flexible research strategy of Grounded Theory provides support to discover new ideas and to look at already well-established fields through an alternate means (Bryman & Bell 2011; Goldkuhl & Cronholm 2010). The outcomes are data driven, capture the complexity of the action as it unfolds and provides a chain of undeniable evidence (Bryman & Bell
Grounded Theory is a method not restricted to particular research types, does not rely on pre-conceived or pre-existing knowledge and notions, and builds its theory upon empirical data (Goldkuhl & Cronholm 2010; Glaser & Strauss 1967; Lyons & Coyle 2007). However, numerous researchers have criticised Grounded Theory. They have reported that the nature of the coding process may cause the data to be misinterpreted, or that the data collected may be too unfocused (Goldkuhl & Cronholm 2010; Lyons & Coyle 2007). Creswell (2007) reported that it was difficult to recognise when categories were saturated. Saturation occurs when no new information arises from subsequently collected data (Glaser & Strauss 1967). Authors suggest that Grounded Theory was hard to categorise due to its differing versions, was time-consuming to learn and perform, had practical difficulties, and has no clear endpoint and the sampling procedures limited generalisation (Bryman & Bell 2011; Glaser 1999; Lyons & Coyle 2007). Grounded Theory is difficult for researchers to undertake without any prior theoretical ideas unless they were at the beginning of their research career (Bryman & Bell 2011; Charmaz 2014; Creswell 2007). Furthermore, the methods incorporated in Grounded Theory research are not straightforward. Researchers may fail to mix methods and integrate findings appropriately, they may need to add or remove methods as they progress, its flexibility may lead to confusion and inefficient design, researchers require intuition and imagination, and projects require multiple stages (Charmaz 2014; Lyons & Coyle 2007; Walsh et al. 2015). Finally, researchers undertaking Grounded Theory have mainly ignored mixed method and quantitative research, rather associating Grounded Theory with qualitative research (Glaser 1999; Walsh et al. 2015).

3.2: Multiple Research Aspects

Scientific research methods describe the general relationship between evidence and theory (Fincher & Petre 2004); producing research questions or statements about worldly human experiences and then testing their authenticity are scientific in approach (Wallace 1974). Wallace (1974, p. 14) explains that ‘[s]cientific methods constitute the rules whereby agreement about specific images of the world is reached’. Two types of scientific research exist. Social science involves working with people, while natural sciences study objects (Neuman 2011; Punch
2005). Scientific research approaches can be performed in any research field and the themes of research are secondary to the instruments and techniques employed (Neuman 2011).

Philosophical views, theoretical considerations and research purposes, together with research aims and questions guide the type of research and data required to undertake a research project. Social science research relies on real-life (empirical) information collected from people. Empirical data is information about real-world experience or observations and gained through qualitative and/or quantitative data collection. The methods used in a research project will naturally follow from the research questions and the factors relating to the phenomenon under investigation. The wording of the question often carries a methodological connection. Words such as ‘variables’, ‘factors’, and ‘determinates’ indicate a quantitative approach, whereas words such as ‘discover’, ‘explore’, and describe’ indicate a qualitative approach (Punch 2005, p. 19).

The researcher began this project with an open mind and hence the project was not restricted to any single methodology, method or design. The central theme of this complex research topic and its research questions led to a multi-faceted approach within a Grounded Theory Investigation. Many authors (see for example Denzin & Lincoln 2011; Gioia & Pitre 1990; Hassard 1991) suggested or used multiple paradigms, they have discussed crossing boundaries and blurring their borders, using more than one to explain the same situation, and serving as an underlying conceptual model in mixed methods research. Linking paradigms provides a thorough view of the phenomenon (Gioia & Pitre 1990). Likewise, the use of multiple methods incorporates the strengths of each approach, reinforces the completeness of the study, and increases result confidence, although it can be time-consuming (Arskey & Knight 1999; Somekh & Lewin 2008).

The remainder of this chapter describes the chosen methods and design aspects and how they relate to this research and their use in this multi-faceted project.

3.2.1: Philosophies of Research

The underlying and often hidden elements of research are the philosophical views; they influence the research practices and assist in determining the selection of methods (Creswell 2007). Authors have referred to philosophical viewpoints as
worldviews, models, positions and paradigms (Creswell 2007; Neuman 2011; Silverman 2005; Urquhart 2013). Research sits within paradigms; paradigms are a fundamental set of values or assumptions about the real world; they provide a way of thinking to direct techniques to make sense of social complexities (Guba 1990; Patton 2002; Punch 2005). Each paradigm views the world in its own way (Gioia & Pitre 1990), where each ‘shapes both what we see and how we understand it’ (Babbie 2007, p. 32). The three world-views explained below all have connotations for this Grounded Theory project.

Pragmatism is ‘a theory of truth’ and a ‘philosophy of common sense’ (Shields 1998, p. 197). Pragmatists view the past to help define the presence of a social situation and focuses on research outcomes, the problem, questions, and solutions rather than on methods (Charmaz 2014; Creswell 2007; Denzin & Lincoln 2011). Researchers examine, inspect and reflect on peoples’ actions, consequences, and subjective and social meanings to link facts and values and to problem-solve (Charmaz 2014; Denzin & Lincoln 2011). Pragmatism guides action and develops theory, achieved by amalgamating quantitative and qualitative data sources through mixed methods (Creswell 2007, 2009; Denzin & Lincoln 2011; Morgan 2007). Morgan (2007) suggested that pragmatism was abductive in nature, Creswell (2009) suggested pragmatism underpinned mixed methods, and Denzin and Lincoln (2011) and Charmaz (2014) suggested that Grounded Theory was abductive and pragmatic, therefore creating strong connections between Grounded Theory, abduction, pragmatism and mixed methods.

Interpretive research makes it possible for the researcher to acquire a thorough understanding of people’s explanations of real-world circumstances by looking into their lives to investigate their opinions and feelings (Fincher & Petre 2004). The goals of interpretivism are ‘to describe and explain’ the phenomena ‘in order to diagnose and understand’ it and to build theory through ‘code analysis’ (Gioia & Pitre 1990 p. 591). Research using an interpretive approach has a qualitative structure (Denzin & Lincoln 2011; Neuman 2011). When using Grounded Theory within an interpretive paradigm there is said to be a co-existence between concepts of coding and formation of meanings (Urquhart 2013).

Research undertaken with a social constructivist view seeks to determine ‘how social reality operates’ (Silverman 2005, p. 268) at a specific time and place
(Charmaz 2014). Social construction focuses on people, their interactions, social contexts, viewpoints, lifestyles, and workplaces and directs meanings toward things and objects (Charmaz 2014; Creswell 2007). Researchers rely on the individuals’ ‘views of the situation’ (Creswell 2007, p. 20) and interpret the findings in a qualitative manner (Charmaz 2014; Denzin & Lincoln 2011). Questions are usually open-ended, general and broad to encourage open discussion of the phenomena under investigation (Creswell 2007). Denzin and Lincoln (2011) and Charmaz 2014 have suggested strong connections between social constructivism and Grounded Theory.

### 3.2.2: Research Streams and Purposes

Scientific research involves three logical streams of research. Inductive reasoning involves drawing conclusions from observations then generalising about those observations; deductive reasoning aims to test predictions to determine if they occur (Babbie 2007; Fincher & Petre 2004); while abductive reasoning extends beyond inductive and deductive reasoning by assessing a possible rule to determine why it may have occurred (Charmaz 2014; Denzin & Lincoln 2011; Neuman 2011). Researchers employing abductive reasoning sequentially evaluate multiple frameworks to describe and contextualise the ideas and data (Neuman 2011) with Morgan (2007) suggesting that abductive reasoning moved in-between induction and deduction. ‘Abductive reasoning advances theory construction’ (Denzin & Lincoln 2011, p. 36). Abduction is evident in sequential data collection methods where a qualitative inductive approach leads to a quantitative deductive approach or vice versa (Morgan 2007).

The purposes of interpreting research are variable and each purpose has a ‘degree of formalization and interpretation’ (Wallace 1974, p. 22). Each research project requires a purpose to assist its design process, although a single project may use more than one purpose (Babbie 2007; Neuman 2011); this project utilises exploratory and descriptive methods.

Research employing an exploratory purpose connects with investigative research through the exploration of a new or little-explored phenomenon (Babbie 2007; Neuman 2011; Wallace 1974). Exploratory research searches for new insights through asking one or more questions from what, when, where, why, who, and
how, and aims to probe into a phenomenon to better understand it (Babbie 2007; Shields 1998; Shields & Tajalli 2006). Often, the intention of an exploratory study is to undertake a subsequent study to test the outcomes (Neuman 2011; Wallace 1974). ‘As a first enquiry, we want to know enough after the exploratory study so we can design and execute a second, more systematic and extensive study’ (Neuman 2011, p. 38). Walsh et al. (2015) define exploratory research as ‘excellent’ for use with Grounded Theory. However, exploratory research is not without difficulties. Wallace (1974) suggests that exploratory research does not formalise hypothetical, theoretical and methodological reasons; Neuman (2011) details that exploratory research does not have defined steps and guidelines or directions of inquiry and that all data was possibly important, rarely resulting in defined answers.

When a researcher wishes to describe a social phenomenon, they undertake a descriptive based research (Babbie 2007; Neuman 2011). These researchers aim to “paint a picture” using words or numbers’ (Neuman 2011. p. 38) through asking who, how, what, where, or when to highlight descriptive categories, attitudes or characteristics that back-up or refute prior research (Babbie 2007; Neuman 2011). Descriptive research can employ any data type and data collection methods (Neuman 2011). Neuman (2011) indicated that the use of the descriptive purpose was widespread in social research and that in practice a blurring between it and exploratory research was evident.

3.2.3: Data and Research Types

The preference of qualitative research is to collect and analyse qualitative data from items such as words, audio, text, images, and/or tactile items to describe or explore something in order to provide extended descriptive narratives that could build and/or test theories (Neuman 2011; Shah & Corley 2006; Silverman 2005). Qualitative research contributes to new knowledge by inductively searching for themes within the data by investigating, studying, interpreting, and understanding peoples’ experiences, events, and things, without the intent of generalising the outcomes (Creswell 2007; Denzin & Lincoln 2011; Punch 1998; Rynes & Gephart 2004). Researchers undertaking qualitative research are often committed to activities in the field through interaction with and/or observation of participants selected through non-probability sampling procedures (Cooper & Schindler 2006;
Neuman 2011; Payne & Payne 2004). Problems with qualitative research include obtaining all necessary consents and cooperation, relying on case studies, generalisation and replication issues, researcher interpretation of participant comments, insufficient transparency, and theoretical issues (Bryman 1988; Bryman & Bell 2011; Cooper & Schindler 2006; Neuman 2011; Payne & Payne 2004); although, Bryman (1988) states that using Grounded Theory may overcome theoretical issues.

Quantitative research focuses on quantitative data in the form of numbers to uncover and examine relationships, causation, and/or associations that occur within and between measured variables in a deductive manner and measures the knowledge, attitudes, behaviours, or opinions of people (Cooper & Schindler 2006; Punch 2005; Rynes & Gephart 2004). Quantitative research depends on experimental research, pre-existing and evolved conceptual frameworks, research questions, probability sampling, hypotheses testing and statistical analysis, to test theories, explain reality and generalise results (Babbie 2007; Cooper & Schindler 2006; Neuman 2011; Punch 2005; Silverman 2005). Critics of quantitative research have noted that it lacks a personal perspective, does not recognise individual differences, fails to recognise social institutions, separates people from their social life, and that the nature of measurement may provide a deceptive sense of precision (Bryman 2007; Bryman & Bell 2011; Cooper & Schindler 2006). Quantitative data is ‘a very rich medium for discovering theory’, although when developing a Grounded Theory, preformed hypotheses and significance testing of relationships are powerful barriers to theory generation (Glaser & Strauss 1967, p. 185).

3.2.4: A Mixed Method Approach

Research undertaken through mixed methods aims to combine techniques of quantitative and qualitative approaches, to increase the research quality, validate findings, obtain richer data, and achieve research objectives, while harnessing the strengths and compensating for the weaknesses of both approaches (Bryman & Bell 2011; Cooper & Schindler 2006; Creswell 2009; Punch 2005; Somekh & Lewin 2008). In an instance when neither quantitative nor qualitative research alone is adequate to provide a complete picture, an alternative is to combine the two into a mixed methods research project (Creswell 2009). Through combining
the two approaches unexpected and surprising results may arise, strengths enhanced and weaknesses reduced (Bryman & Bell 2011; Tashakkori & Teddlie 1998). Varying amounts of mixing could be involved with equal or unequal priority of one method over any other (Creswell 2009). Tashakkori and Teddlie (1998) and Venkatesh, Brown and Bala (2013) state that the reasons behind the use of mixed methods are to complement, complete, develop, expand, confirm, corroborate, compensate and diversify. Mixed Method Research is not limited to just using multiple approaches; it could involve more than one philosophy, purpose, theory, investigation, data source, data type, and data analysis (Arskey & Knight 1999; Charmaz 2014). Charmaz (2014) considers the use of Grounded Theory with mixed methods as a recent occurrence.

Editors, authors and academics determine mixed methods in different ways, and as such, the nature of mixed methods research is yet to be specifically defined (Tashakkori & Creswell 2007). Cooper and Schindler (2006) suggest combining different methods within the qualitative realm in the same study or combining both quantitative and qualitative methods. Tashakkori and Creswell (2007, p. 4), broadly define mixed methods as ‘research in which the investigator collects and analyzes data, integrates the findings, and draws inferences using both qualitative and quantitative approaches or methods in a single study or a program of inquiry’.

Mixed method research incorporates different strategies of combining quantitative and qualitative methods; this project uses the sequential approach. Sequential strategies involve at least two separate phases with one phase conducted after the other and in a different time span (Bergman 2008; Creswell 2009; Guest 2013; Teddlie & Yu 2007). The results of one phase inform the next phase where the researcher strives to expand, elaborate on, or confirm the results of the previous phase (Bergman 2008; Creswell 2009; Guest 2013; Teddlie & Yu 2007). Sequential strategies require considerable time to complete (Creswell 2009; Bergman 2008).

3.3: Population and Sampling

The population considered for any research should be the ‘most appropriate for the project’ (Benbasat, Goldstein & Mead 1987, p. 372), and meet the criteria under consideration (Patton 2002). The research sample is a subset of the population from where data is collected and where the sample resembles the
original population (Babbie 2007). Using a sample instead of the whole population costs less, takes less time, and requires fewer researchers to collect data (Babbie 2007; Punch 2005; Sapsford 2007).

Bernard (2000) indicated that when investigating individuals’ lived experiences a suitable sample would be non-probabilistic and consisting of purposively selected key informants. Grounded Theory generally accepts purposive sampling for its investigations (Lyons & Coyle 2007). Often non-probability sampling is chosen for qualitative research for its convenience, economy and ease of participant selection (Babbie 2007; Ezzy 2002). Purposive sampling selects unique and informative participants based on their usefulness to fulfil specific research purposes for in-depth investigations of achieving a deep understanding of a phenomenon (Creswell 2007; Neuman 2011; Teddlie & Yu 2007). Individuals are required to provide details for themselves since ‘no individual can report feeling, opinions, or knowledge for some other person’ (Fowler 2009, p. 35).

Determining what size the sample should be is dependent on the research considerations and questions, and can range upwards from a single participant or case (Creswell 2007; Teddlie & Yu 2007). Creswell (2007) suggests 20 to 30 participants for Grounded Theory studies, and Teddlie and Yu (2007), fewer than 30 for purposive sampling. Qualitative studies are usually smaller in sample size number than quantitative studies, and in some cases, no defined number of participants are predetermined; sampling continues until the data is saturated (Corbin & Strauss 2008; Ezzy 2002).

3.4: Research Time Span

When a research purpose includes descriptive research, a cross-sectional time span often prevails (Babbie 2007). In a cross-sectional study, researchers observe a sample or a phenomenon at a particular point of time (Babbie 2007) to generate a “snapshot” of social life’ (Neuman 2011, p. 44). Cross-sectional studies aim ‘to identify and understand differences between the various members of the study population’ (Remenyi et al. 1998, p. 47). Completion may take from a few weeks to several months, although sometimes data cannot be collected all at once but is still considered cross-sectional, though the actual time span may be ‘irrelevant and ignored’ in some instances (Neuman 2011, p. 44).
3.5: Grounded Theory Processes of Analysis

Grounded Theory relies on coding stages, which are sequential and consecutive although not repetitive; with constant comparison, memoing, and theoretical sampling occurring within any part of a Grounded Theory study (Andersen, Inoue & Walsh 2013; Glaser & Strauss 1967; Jones & Alony 2013). During open coding, the researcher reads and rereads all the data line-by-line, fragments it into meaningful pieces, and organises them into blocks of similar content and labels the codes (Glaser & Strauss 1967; Jones & Alony 2013; Urquhart 2013). Instances occur when some data pieces belong to more than one code (Lyons & Coyle 2007). Open codes lead the direction of research and their number is not restricted (Glaser 1978).

The second level of coding is selective coding where open codes and their content are filtered, revised, refined, grouped, separated, and/or rearranged into larger codes with sub-categories, as core categories (Glaser & Strauss 1967; Jones & Alony 2013; Lyons & Coyle 2007; Urquhart 2013). ‘Core categories can emerge in the sociologist’s mind from his readings, life-experiences, research and scholarship’ (Glaser & Strauss 1967, p. 90). During selective coding, only the relevant codes and valued data pieces are included in the core categories (Glaser 1978; Jones & Alony 2013). At this stage of research no further open codes appear, core categories become saturated, and core categories relate meaningfully to each other (Glaser & Strauss 1967; Jones & Alony 2013; Urquhart 2013).

The final coding stage is theoretical coding. Here core categories are organised and integrated into broad categories where the aim is to saturate theoretical core categories as thoroughly as possible, while disregarding and abandoning the less relevant and least saturated categories (Glaser & Strauss 1967; Jones & Alony 2013; Lyons & Coyle 2007; Urquhart 2013; Urquhart, Lehmann & Myers 2010). During theoretical coding, all data is explored and analysed, researchers decide upon the relationships that connect the core categories, how they fit together and increases the level of abstraction (Glaser & Strauss 1967; Jones & Alony 2013; Urquhart 2013). Theoretical coding modifies the core categories resulting in theory formation (Glaser & Strauss 1967; Urquhart, Lehmann & Myers 2010).
Researchers employ constant comparison to reflect on the data by moving back and forth between the data already coded, newly collected data and if necessary further data collection to verify or dispute the previously collected data (Creswell 2007; Denzin & Lincoln 2011; Glaser & Strauss 1967; Jones & Alony 2013). The process continually checks and compares data instances through comparison, condensation, limitation, and expansion to saturate the codes (Glaser & Strauss 1967; Urquhart 2013). Constant comparison is the heart of Grounded Theory, improving conceptual understanding, and leading to theoretical categories (Charmaz 2014; Urquhart 2013; Urquhart, Lehmann & Myers 2010).

Researchers use memos to record, develop, and analyse their ideas, thoughts, reflections, elaborations, data notes, codes, code properties, and code relationships (Glaser 1978; Glaser & Strauss 1967; Lyons & Coyle 2007; Urquhart 2013). They assist in the creation of new ideas, codes, sub-categories, themes, and core categories; in addition to codes, memos assist in building tentative theory and guide future sampling to delimit, test, and/or adjust that tentative theory (Creswell 2007; Glaser & Strauss 1967; Jones & Alony 2013; Urquhart 2013). Researchers temporarily stop the coding process to record memos so as not to lose their thoughts, and memos can be modified, sorted and attached to codes, although they must be kept separate from the data (Glaser 1978).

Future sampling to enrich Grounded Theory data occurs through theoretical sampling. Shah and Corley (2006) and Williamson (2002) compare theoretical sampling with purposive sampling, with Lyons and Coyle (2007) distinguishing the difference of theoretical sampling as ongoing and guided by the emerging theory. Theoretical sampling may occur within and/or between any stages of research and incorporates the selection of participants or participant groups for the next data collection based on the outcomes of the previous stage (Andersen, Inoue & Walsh 2013; Cooper & Schindler 2006, Glaser 1978; Glaser & Strauss 1967; Urquhart 2013). Theoretical sampling aims to include participants from all significant sub-groups from the sample; instances appear where past participants recommend future participants (Glaser 1978; Urquhart 2013; Williamson 2002). Glaser (1978) suggests two steps to theoretical sampling, initially targeting similar participants, and then broadening the sample to include participant differences within the substantive area. Theoretical sampling ceases when the researcher
judges that theoretical saturation has occurred (Glaser & Strauss 1967; Urquhart 2013; Urquhart, Lehmann & Myers 2010). Theoretical sampling is a foundation of Grounded Theory and distinguishes it as abductive (Urquhart 2013). Theoretical sampling assists in the development of research questions and selection of core categories and expands the generalisability of Grounded Theory (Glaser & Strauss 1967; Urquhart 2013; Urquhart, Lehmann & Myers 2010).

3.6: Research Phases

This research occurred in two sequential phases: The first phase consisted of a preliminary exploratory study to seek out issues around ICT education from the perception of ICT teachers. Two of the emerging issues became the focus of the second phase, with ICT and non-ICT teachers. Urquhart (2013, p. 65) indicated that when designing research with Grounded Theory that ‘if you have a two-phase research design, you can ensure that the concepts emerging from the first phase influence sampling in the second’ showing ‘sensitivity to emerging themes in the data’. Shields (1998) suggested the use of interviews for exploratory research and surveys for descriptive research. To distinguish the interview sample from the survey sample; the interviewees are participants and the questionnaire takers, respondents.

3.6.1: Research Phase 1

3.6.1.1: Interviews

Interviews are an appropriate data collection method for Grounded Theory studies with conversational semi-structured interviews most relevant (Denzin & Lincoln 2011; Lyons & Coyle 2007; Urquhart 2013). Semi-structured interviews, based on an interview guide, are flexible and provide opportunities for the interviewer to probe the interviewee for clarity and information about his/her opinions, experiences, perceptions and knowledge (Patton 2002; Payne & Payne 2004; Punch 2005).

Interviews mainly collect qualitative data in a two-way discussion between interviewers and interviewees, focusing on obtaining data about particular topics, and how the interviewees think and feel about them (Cooper & Schindler 2006; Patton 2002; Payne & Payne 2004; Punch 2005; Silverman 2004). Interviews in Grounded Theory confirm and/or elaborate prior collected data (Glaser & Strauss
Interviews conducted with assessable participants were face-to-face, and those with distant participants were over the telephone. The interviews were semi-formal, relaxed and friendly, with multiple opportunities for open discussion to investigate issues raised. Face-to-face interviews are the most common form and allow for participant cooperation, rapport and confidence building, with multiple data collection opportunities such as body language and visual cues (Bernard 2000; Cooper & Schindler 2006; Fowler 2009). However, this method can be costly, data collection may take longer, interviewer training may be necessary, interviewers presence may alter responses, and can be seen as intrusive (Bernard 2000; Creswell 2009; Fowler 2009; Payne & Payne 2004). Telephone interviews save on travel expenses and time, are convenient, safe for the interviewer, take less time to conduct and can access a wider population (Bernard 2000; Cooper & Schindler 2006; Fowler 2009). They are however limited to people with telephones, have to be short, and the researcher cannot gather non-verbal signals (Bernard 2000).

### 3.6.1.2: Interview Participants

The overall project utilised a combination of key informants. Key informants are those who possess specific expertise or knowledge about the topic (Bernard 2000; National Health and Medical Research Council, Australian Research Council & Australian Vice-Chancellors’ Committee [NHMRC, ARC & AV-CC] 2007; Payne & Payne 2004). Payne and Payne (2004) indicate that teachers fit into the category of ‘key informant’ as they occupy a position of authority at a single organisation such as a school.

Phase 1 consisted of key informants purposefully and theoretically selected, classified as *ICT teachers* (see Section 1.5), taught secondary aged students, and were located at different schools throughout Victoria. The schools represented a fair and equitable representation of Victoria’s population, regions, and school classification (Tables 3.1, 3.2). Initial contact with potential participants occurred in person or via email through professional contacts (Appendix D.1). Those interested provided an email contact and sent research documentation.
(Appendices D.2 & D.3). In total fourteen participants agreed, four later withdrew due to education industrial action, scheduling and personal reasons, resulting in ten semi-structured interviews.

The *Australian Standard Geographical Classification* (AGSC) (ABS 2001) combined with the *Rural, Remote and Metropolitan Areas (RRMA) Classification* (Australian Institute of Health and Welfare 2013) classify Victoria into a number of regions (Table 3.1). Each region’s size is dependent on the size of the population of that region’s cities.

<table>
<thead>
<tr>
<th>AGSC Classification</th>
<th>RRMA Classification</th>
<th>Interviewee representation</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of Victoria’s population</td>
<td>Zone</td>
<td>Zone Code</td>
</tr>
<tr>
<td>Major cities</td>
<td>Metropolitan</td>
<td>M1</td>
</tr>
<tr>
<td></td>
<td>Metropolitan</td>
<td>M2</td>
</tr>
<tr>
<td>Inner Regional</td>
<td>Rural</td>
<td>R1</td>
</tr>
<tr>
<td></td>
<td>Rural</td>
<td>R2</td>
</tr>
<tr>
<td>Outer regional</td>
<td>Rural</td>
<td>R3</td>
</tr>
<tr>
<td>Remote</td>
<td>Remote</td>
<td>Rem1</td>
</tr>
<tr>
<td>Very Remote</td>
<td>Remote</td>
<td>Rem2</td>
</tr>
<tr>
<td>Migratory</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3.1: Comparison of Victoria’s regions and interviewee representation

Victorian School types are government and non-government; with non-government schools sub-divided into Catholic and Independent sectors (ABS 2014) (Table 3.2).
School Classification | Victorian Representation | Interviewees Representation
--- | --- | ---
Government | 69% | 70%
Catholic | 22% | 20%
Independent | 9% | 10%

Table 3.2: Comparison of Victoria’s schools in 2013 and interviewee representation

Interviews occurred in three rounds with participants grouped by ICT teacher position and conducted sequentially from junior to positions that were more senior to determine if any differences in opinions existed within ICT teachers employment positions (Table 3.3). The first round consisted of two interviews with those employed as classroom teachers, the second round, four interviews with leading teachers, and the final round with four teachers who were heads of departments. Classroom teachers focus on preparation, planning, and teaching students to achieve specific outcomes (DET 2015b). Leading teachers are those that are highly skilled classroom teachers who also engage in management and leadership roles (DET 2015b). While those employed as ‘heads of discipline’ are experts in that particular subject area (DET 2015c, p. 4). The first round of interviews occurred in June 2012, the second in April and May 2013, and the third in November and December 2013.

Interview times ranged from 41 minutes to 14 minutes (Table 3.3). Face-to-face interviews occurred before school, during non-teaching times, or after school and averaged 28 minutes, telephone interviews occurred during non-teaching times and averaged 18 minutes, verifying interview time lengths mentioned in Section 3.6.1.1. Average interview time for the first round was 35 minutes, the second round, 23 minutes and the third round 22 minutes. Glaser and Strauss (1967) indicated that with theoretical sampling interview times reduced as research progressed, and the questions became more focused on the emerging theory.

The Australian Bureau of Statistics separates schools into groups according to enrolment numbers (ABS 2014). For the purpose of this research, schools are determined as small for those of less than 400 students, medium for between 401 and 800 students, and large for schools of greater than 800 students.
<table>
<thead>
<tr>
<th>Interviewee</th>
<th>Current Position</th>
<th>School Type (enrolment)</th>
<th>Region</th>
<th>Interview Method</th>
<th>Time (minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elizabeth</td>
<td>Maths teacher</td>
<td>Public Secondary (1180)</td>
<td>M2</td>
<td>Face-to-face</td>
<td>41</td>
</tr>
<tr>
<td>Sarah</td>
<td>IT teacher, all IT issues</td>
<td>Private Combined Non-Catholic (140)</td>
<td>R2</td>
<td>Face-to-face</td>
<td>30</td>
</tr>
<tr>
<td>Miriam</td>
<td>Junior Secondary IT teacher &amp; Leader</td>
<td>Private Catholic Secondary (630)</td>
<td>R3</td>
<td>Face-to-face</td>
<td>33</td>
</tr>
<tr>
<td>Matthew</td>
<td>Leader 7-9 curriculum development</td>
<td>Public Secondary (692)</td>
<td>R2</td>
<td>Telephone</td>
<td>22</td>
</tr>
<tr>
<td>Grace</td>
<td>e-learner leader, ICT mentor</td>
<td>Public Secondary (925)</td>
<td>M2</td>
<td>Face-to-face</td>
<td>21</td>
</tr>
<tr>
<td>Seth</td>
<td>ICT administrator, Aspire Leader</td>
<td>Public Combined (2031)</td>
<td>M2</td>
<td>Face-to-face</td>
<td>15</td>
</tr>
<tr>
<td>Simon</td>
<td>Head of IT</td>
<td>Public Combined Sp. Ed (340)</td>
<td>M2</td>
<td>Face-to-face</td>
<td>35</td>
</tr>
<tr>
<td>Abigail</td>
<td>Head ICT Faculty</td>
<td>Public Secondary (1450)</td>
<td>M1</td>
<td>Face-to-face</td>
<td>24</td>
</tr>
<tr>
<td>Martha</td>
<td>Head of Maths 7-9</td>
<td>Public Secondary (1050)</td>
<td>M1</td>
<td>Telephone</td>
<td>17</td>
</tr>
<tr>
<td>Delilah</td>
<td>Head ICT curriculum</td>
<td>Private Non-Catholic Combined Girls (1200)</td>
<td>M1</td>
<td>Telephone</td>
<td>14</td>
</tr>
</tbody>
</table>

Table 3.3: Rounds of interviewed participants

### 3.6.1.3: Data Collection Instrument

Development of the interview instrument involved formulating open-ended questions to guide discussion and delve into ICT teachers’ opinions, observations, and experiences of teaching ICT. Presentation of questions was one at a time, each contained a clear meaning and a dominant idea; the answers provided were probed deeper with the use of prompts and follow-up questions where necessary.
(Patton 2002). Formulation of the topical areas was on anecdotal evidence, theoretical ideas, government and media reports, prior research, preparatory reading, personal conversations, experiences and interest in the subject. Prior to each successive round of interviews, an initial analysis was undertaken and question guidelines were further refined to reflect the data already collected. Pilot testing of interview questions occurred prior to each round through discussions with academics and out-of-service teachers. A copy of the interview question guidelines is in Appendices D.4, D.5, and D.6.

3.6.1.4: Data Analysis

Qualitative research techniques often generate a large amount of data (Bryman & Bell 2011), with Punch (2005, p. 194) indicating that ‘there is no single right way to do qualitative data analysis’. The process of coding breaks the data into smaller pieces and assigns labels, followed by reconstruction in a different way to produce new understandings (Beekhuizen, Nielsen & von Hellens 2010). During the coding process, Ryan and Bernard (2003) suggest identification of themes by looking for repetitions, transitions, metaphors, linguistic connections, theory related details, and similarities and differences. However, the coding process may lead to losing the context by breaking up the data (Bryman & Bell 2011).

Throughout the face-to-face interviews, maintenance of maximum eye contact to engage the interviewee occurred; hand-made notes collected, and any additional information to a digital recording made after the close of the interview. At the conclusion of each round of interviews, transcription of recordings occurred, files altered to reflect ethical requirements and hand-made notes added. Throughout Phase 1 all collected data was analysed to extract underlying themes using Grounded Theory open and selective coding methods and incorporated constant comparison and a few memos.

Coding and initial analysis occurred with the aid of the QSR NVivo qualitative software package. The program allows for data management through importation, storage, exploring, coding, viewing, querying, and visualising so that researchers can use multiple options to reflect upon and analyse their data in the one place to draw conclusions (Bazeley & Jackson 2013; Creswell 2007; O’Neill 2013). The NVivo project summary is provided in Appendix G.1, a sample of a node
summary page in Appendix G.2, the final node structure in Appendix G.3, and a node structure screenshot for ‘Teacher Qualifications’ in Appendix G.4. However, when concentrating on coding with software, the results are reliant on the user’s software skills, researchers need to learn how to operate, understand, and use it, and the analysis may exclude other possible analysis methods (Bazeley & Jackson 2013; Creswell 2007; O’Neill 2013).

3.6.2: Research Phase 2

3.6.2.1: Online Survey

The second phase of this research concentrated on collecting data on the selected core categories, which emerged during Phase 1 analysis, through an online questionnaire. Survey research is a form of non-experimental research involving the use of a questionnaire to collect information on trends, opinions, experiences, preferences, or attitudes, with an aim of generalising the results (Bernard 2000; Creswell 2009; Fowler 2009; Neuman 2011). Surveys can collect both quantitative and qualitative data and are a valid data collection method for any research purpose (Babbie 2007; Creswell 2009). Online questionnaires are relatively easy to design and develop, many software programs include instructions and tutorials, provide a variety of answering options, allow inclusion of additional visual and audio stimuli and question filtration, are less likely to have data entry errors, record results almost immediately, and often automatically code responses (Bryman & Bell 2011; Cooper & Schindler 2006; Williamson 2002). However, technology is not perfect, instructions may be misleading or confusing, scales may not be representable, incomplete questionnaires present quality problems, and researchers require some technical skills and time to learn the software (Bryman & Bell 2011; Cooper & Schindler 2006; Fowler 2009; Williamson 2002).

The main strength of survey research is question standardisation where each respondent receives the exact same questions to answer (Babbie 2007). They may contain two question types. Open-ended questions are qualitative in nature and are appropriate to use when a long list of possible answers exists or when the respondent provides additional information (Babbie 2007; Fowler 2009; Remenyi et al. 1998). Closed questions are quantitative in nature, have pre-determined
responses and are quick and easy to respond to (Babbie 2007; Fowler 2009; Remenyi et al. 1998). When forming the survey, questions need to be short, simple, clear, relevant, and unbiased, cover a single topic and avoid jargon, negative words, leading questions, and emotional language (Neuman 2011; Payne and Payne 2004; Punch 2003). The layout should include questions grouped into topical areas, not be overcrowded, start with general questions, position specific questions in the middle, and place demographic questions toward the end of the questionnaire (Cooper & Schindler 2006; Fowler 2009; Neuman 2011; Payne and Payne 2004). Once online questionnaires are completed, the results may need checking for errors (Fowler 2009; Neuman 2011).

However, with surveys question interpretation is up to the respondent, they need clear instructions and no guarantee exists for whom completes it (Babbie 2007; Cooper & Schindler 2006). Open questions give rise to irrelevant responses or no response at all, and the respondent requires more time and thought to answer them (Babbie 2007; Neuman 2011; Remenyi et al. 1998). Closed questions force the respondent to make a choice, the options may be too limited, or the respondent may mistakenly mark the wrong response (Babbie 2007; Neuman 2011; Remenyi et al. 1998).

3.6.2.2: Survey Respondents

Challenges exist in obtaining samples for online surveys; unless a sample list of respondents with Internet access exists, non-probability samples are unavoidable (Bryman & Bell 2011; Williamson 2002). Online survey respondents feel anonymous and are more likely to contribute honest answers, they find the survey easy to complete and are able to save and return later to complete it; however, they do require adequate technological and literacy skills (Bryman & Bell 2011; Cooper & Schindler 2006; Fowler 2009; Williamson 2002).

Upon analysis of Phase 1 collected data, no discernible differences in opinions were evident in the three levels of ICT teachers interviewed. Employing theoretical sampling, as suggested by Glaser (1978), an extension of the sample for the second phase comprised a different group of teachers. The intention was to see if those opinions raised in Phase 1 were restricted to those interviewed or were more widespread and to test and build upon the developing theory. These aspects,
when further explored, would determine the generalisation extent of the findings.

Questionnaires typically have a history of low response rates (Bryman & Bell 2011; Cooper & Schindler 2006); however, broadening the sample to Australia wide would minimise this issue. This decision then brought about a new problem of how to contact as many Australian teachers as possible. To achieve this, publication of an advertisement in the Australian Teacher Magazine (2014) occurred (Appendix D.7). The publishers describe the magazine as:

*The largest independent publication for the education sector and provides an unparalleled source of news and information relevant to teachers’ careers and industry developments* (Tempo Media n.d.).

The publishers indicated that its monthly distribution reached most, if not all Government, Independent, and Catholic schools within Australia (Audited Media Association of Australia 2014). They distribute over 12,000 digital copies and around 43,000 printed copies monthly, estimated as reaching at least 210,000 educators in Australia per month (Audited Media Association of Australia 2014).

Unfortunately, responses to the questionnaire were few in number; 44 respondents from Victoria accessed the survey, eight were unusable, resulting in 36 usable surveys. Although the aim was to survey non-ICT teachers, a few ICT teachers also completed the survey and hence Phase 2 included a combination of all informant types.

Figure 3.1 depicts how the projects sequential data collection from Phase 1 led to the data collection for Phase 2.

![Figure 3.1: Sequential data collection strategies](image)

Phase 1: Interviews with ICT teachers
- 2 classroom teachers
- 4 leading teachers
- 4 heads of departments

Phase 2: Online survey with 7 ICT and 29 non-ICT teachers
3.6.2.3: Data Collection Instrument

Measurement and recording of data need to occur in some way so that analysis can be undertaken. Measurement in research involves deciding what value to record for an activity, object, property, or event; the value can be either numerical or textual (Bernard 2000; Cooper and Schindler 2006; Punch 2005). Payne and Payne (2004, p. 139) list measurement as having the capacity to ‘yield very short and specific descriptions’, ‘define and differentiate between things very precisely’, and ‘manipulate numbers directly’. A variable is a concept or idea that Bernard (2000, p. 30) describes as ‘something that can take more than one value and those values can be words or numbers’. Variables are a measured quantity based on nominal, ordinal, interval or ratio measures (Sapsford 2007). The researcher chooses the variables and their specific values or attributes based upon what is under investigation, those variables with only two attributes or categories are classed as dichotomous (Bernard 2000; Bryman & Bell 2011; Somekh & Lewin 2008).

This research incorporated the software program, Qualtrics Survey Solutions, to design and administer the online questionnaire; the anonymous link option protects respondents’ privacy. Fowler (2009), details that to ensure confidentiality in data collection the respondents’ answers are to remain confidential and not contain identifying marks. On access to the online questionnaire, potential respondents viewed the first page that included a brief outline of the research and a link to the plain language statement (Appendix E.1). After reading the information, they agreed to either continue or leave the questionnaire. If they agreed, they progressed to the first question page; otherwise, they received a ‘thank you for your cooperation’ message. The online questionnaire consisted of 40 questions divided into six sections; some questions contained multiple sub-questions. Respondents were able to save and leave the survey, and return within two weeks to complete it. The questionnaire was open for four months from early October to the end of December 2014.

Prior to administration, the questionnaire was pilot tested with pre-service teachers in their final year of university education studies. Pilot testing ascertains if there are any weaknesses in the design, instructions and measures used, and checks for clarity of readability, wording and interpretation (Cooper & Schindler...
The testers undertook the questionnaire, recorded the time taken, critically assessed it, marked issues they did not understand or were unclear about, and indicated suggestions for improvement. Adjustments to the questionnaire reflected pilot test comments prior to its implementation online.

The survey for this project recorded descriptive, nominal and ordinal measured variables. Descriptive variables simply report on something and are not included for inferences, causality, or conclusions (Sapsford 2007). With nominal measures, the categories are qualitative, have no order, and no relationship (e.g. coffee, tea, hot chocolate, hot water, soup) (Cooper & Schindler 2006; Sapsford 2007; Payne & Payne 2004). Ordinal measures contain labelled categories in a designated order with some relationship present, the differences between categories are at the discretion of the respondents, the order is a rank only and does not signify a size or interval meaning (e.g. no association, some association, completely associated) (Bernard 2000; Bryman & Bell 2011; Payne & Payne 2004; Sapsford 2007). Nominal and ordinal measures have distinct categories that are mutually exclusive; in the case where the categories are numeric, these are only labels, have no arithmetic value, are able to be counted, but cannot be divided or multiplied (Payne & Payne 2004; Punch 2005; Sapsford 2007).

Measurement of the categories of nominal and ordinal variables was via Likert scales with the resultant selections recorded as a numeric code for ease of analysis. Likert scales, often used with surveys, have a degree of intensity or difference (e.g. strongly disagree, slightly disagree, neither agree nor disagree, slightly agree, strongly agree) (Babbie 2007; Bernard 2000; Payne & Payne 2004). Brace (2004, p. 82) explains that ‘a five point scale gives sufficient discrimination for most purposes and is easily understood by respondents’.

The online questionnaire included closed and open-ended questions and statements and developed from Phase 1 selected outcomes supported by literature investigation. Closed-ended questions were measured as either dichotomous, multiple select, or on a five point Likert scale of categorical choices (Table 3.4). Verbatim recording of the answers to open-ended questions occurred. The questionnaire measured involvement at school, the extent of knowledge, utilisation of ICT tools in classes, experiences, the strength of preference for statements, and some generic personal information. Appendices E.2 and E.3 show
the questionnaire and questionnaire sample screenshot.

<table>
<thead>
<tr>
<th>Question Type</th>
<th>Variable Type</th>
<th>Questions (*dichotomous, # multiple select)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ordinal</td>
<td>4, 7, 8, 9, 11, 12, 14, 15, 24, 25, 26, 28, 29, 30, 31</td>
</tr>
<tr>
<td>Open-ended (qualitative)</td>
<td></td>
<td>1, 2, 3, 10, 13, 16, 17, 18, 19, 20, 21, 23, 27, 39, 40</td>
</tr>
</tbody>
</table>

Table 3.4: Online questionnaire variable types and measures

To determine the cohesive strength of a questionnaire, testing the measurement reliability of a survey’s quantitative questions, their consistency, and the dependability of variable measures, reliability of scale is determined after data collection (Fowler 2009; Neuman 2011). The test determines stability over time, repeatability, reliability across subgroups or cases, and consistent measuring over different indicators (Neuman 2011). Reliability of scale tests the internal consistency of multiple items to determine scale coherence and item consistency through Cronbach’s alpha coefficient (Babbie 2007; Bryman & Bell 2011). The minimum generally accepted limit of the Cronbach’s alpha coefficient is 0.70, with 0.80 or above being preferred, although the more items in the scale the higher the value (Hair et al. 2006; Pallant 2011). The internal scale consistency and coherence of the ordinal Likert scale items indicating acceptable levels of internal consistency of between 0.718 and .875 for individual sections, and 0.844 overall (Table 3.5). A combination of precise measurement levels, clear constructs, allocating each measure to only one thing, using multiple indicators, and pilot testing preliminary versions assist with food measurement outcomes (Neuman 2011).
### Table 3.5: Online questionnaire scale reliability

<table>
<thead>
<tr>
<th>Section</th>
<th>Section name</th>
<th>Ordinal Items</th>
<th>Cronbach’s Alpha</th>
<th>Number responses (excluded listwise)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>About Your School</td>
<td>0</td>
<td></td>
<td>36 (0)</td>
</tr>
<tr>
<td>2</td>
<td>About Computing Skills</td>
<td>6</td>
<td>0.718</td>
<td>36 (0)</td>
</tr>
<tr>
<td>3</td>
<td>About Your Past Computing Professional Experiences</td>
<td>3</td>
<td>0.841</td>
<td>29 (7)</td>
</tr>
<tr>
<td>4</td>
<td>About Your Future Computing Professional Wishes</td>
<td>46</td>
<td>0.861</td>
<td>31 (5)</td>
</tr>
<tr>
<td>5</td>
<td>About Yourself</td>
<td>2</td>
<td>0.875</td>
<td>32 (0)</td>
</tr>
<tr>
<td>All items</td>
<td></td>
<td>57</td>
<td>0.844</td>
<td>25 (11)</td>
</tr>
</tbody>
</table>

#### 3.6.2.4: Data Analysis

At the completion of the questionnaire’s access time, downloading of all results in Microsoft Excel and Statistical Package for Social Sciences (SPSS) formats, and several survey reports in PDF and Word format occurred. Prior to analysis, recommendations are to prepare the data and create a codebook. The data should be checked for accuracy and errors against the original data source if possible, entered into a computer statistical analysis program, and each variable, category and missing value named, labelled and coded numerically, and variables transformed and recoded as required (Bryman & Bell 2011; Neuman 2011; Pallant 2011). The codebook records all the questions or statements, variables, categories, and codes assigned to them; it is the ‘key to the data’ (Appendix E.2) (Neuman 2011 p 384). After data recording and correction, data analysis follows. The type of data analysis performed depends on the research questions, the type of data collected, and collection techniques, and assists the researcher in interpreting and reporting new information (Bernard 2000; Punch 2005).

Quantitative data requires analysis with statistical procedures; many statistical tests looking for something occurring by chance. Typically, the most common level of significance or confidence set is 95% or probability of .05; however, it has been known for levels to be set to other values such as 90%, 98%, or 99%.
(Black et al. 2013; Field 2009). Black et al. (2013) details that the larger the sample, the smaller the confidence interval set. A ‘complicated mystery’ surrounds the justification for a 95% level (Field 2009, p. 51). A small effect does not always relate to the importance of significance, and insignificant results should never mean that no relationship is evident (Cohen 1990 as cited by Field 2009; Field 2009).

Quantitative analysis for this project was severely restricted due to nominal and ordinal variables, non-probability sampling, and a small sample size. According to Anderson, Sweeney and Williams (2006), Somekh and Lewin (2008), Tashakkori and Teddlie (1998), and Williamson (2002), unsuitable tests on these data types are measures of central tendency, standard deviation, variances, and inferential parametric and non-parametric methods. Consequently, the analysis for this research phase was limited to descriptive methods. In descriptive statistics, some tests such as those with categorical variables do not utilise measures of central tendency (Pallant 2011).

Descriptive statistical methods are available for univariate and bivariate analysis; their descriptive summaries may include visual and tabular displays (Bernard 2000; Bryman & Bell 2011). Univariate analysis takes one variable at a time and examines its data descriptively in order to understand it (Bernard 2000; Bryman & Bell 2011). Descriptive univariate techniques explore the data and do not draw conclusions about the sample; they provide summaries and images of variables to assist in understanding the nature of each variable (Tashakkori and Teddlie 1998; Somekh & Lewin 2008).

Bivariate exploration of variables looks at relationships between two variables and their categories; the most basic form of a bivariate analysis is cross-tabulation (Babbie 2007; Hair et al. 2006; Neuman 2011). Cross-tabulation compares the data of selected variables and displays a table of results to assist in determining variable association (Anderson, Sweeney & Williams 2006; Cooper & Schindler 2006; Hair et al. 2006). Grounded Theory quantitative samples can be analysed by cross-tabulating two quantitative or one quantitative and one qualitative variable to discover relationships (Anderson, Sweeney & Williams 2006; Glaser & Strauss 1967). Cross-tabulation leads to discovering relationships between concepts; the researcher can incorporate cross-tabulation to test a questionnaire variable with
any other variable of interest (Glaser & Strauss 1967). An additional output to cross-tabulation analysis is the Chi-Square tests for independence table that includes a Chi-Square approximate significance value.

However, Chi-Square test results are questionable with small samples and expect cell frequencies to be at least ‘5’ to be considered reliable, and if two dichotomous variables are used for cross-tabulation the cell counts should be at least 10 (Kirkpatrick & Feeney 2003; Pallant 2011; Sapsford 2007). When a large number, 80% or greater, of the cells have a count of less than 5, then the results must be interpreted with considerable caution and not be relied upon statistically (Kirkpatrick & Feeney 2003; Pallant 2011). Black (2008) and Pallant (2011) suggest that to overcome the issue of minimum cell count, the researcher can combine the category results into a lesser number of options. During the analysis of data, Glaser and Strauss (1967) summated variables and/or variable categories to determine relationship existence.

The analysis for Phase 2 of this project utilised selective and theoretical coding. Univariate analysis of the nominal and ordinal variables described the data collected, qualitative analysis of textual data were thematically sorted, and bivariate analysis of variables through using cross-tabulations determined if any relationships existed. Due to the low sample number and a lot of cell frequencies in cross-tabulations violating the 80% rule it was necessary to combining attribute options into two or three categories overcome these issue. Even though statistical significance is not of great importance to Grounded Theory, this project needed a strength of relationship indicator. Consequently, the choice of a Chi-Square significance value of 0.10 occurred due to the small sample size to determine whether any relationships existed. Additionally, mean values were included into tables in Section 7.4. Anderson, Sweeney, and Williams (2006) describe the mean or average as being calculated by adding up all of the values and divide the sum of the values by the number of values. The use of mean values was to order the results for ease of discussion and to indicate where the average of preference falls for each option.

3.7: Ethical Issues in Social Research

In social research involving human participation, researchers are obliged to conduct it according to legal and ethical guidelines through Federal Law,
Institutional Ethical Boards, and professional codes of conduct (Babbie 2007; Bickman & Rog 2009). These stipulate acceptable and unacceptable behaviour by researchers to protect the interests of participants (Babbie 2007; Bickman & Rog 2009). The Australian National Statement on Ethical Conduct in Human Research details ethical values, principles, themes and considerations that are essential in human research (NHMRC, ARC & AV-CC 2007). The key areas that ethical research must consider are the assessment of risk, obtaining consent, maintaining privacy, being forthcoming, research monitoring, and use and storage of information. This two-phased project obtained two low-risk ethical applications and clearances by the University Faculty Ethics Board.

Ethical codes stipulate that when assessing the risk involved in social research any possible harms should be minimised (Babbie 2007; Bryman & Bell 2011; Payne and Payne 2004). The risks involved in this project were minimal for all participants and consisted of a minimal cost of involvement, possible discomfort and inconvenience, and time taken for involvement. Phase 1 participants could have experienced interview anxiety, discomfort or embarrassment while voice recorded, and/or talking about their personal opinions on the topic. While Phase 2 respondents may have experienced mental and/or physical discomfort while completing the online questionnaire.

Research participation was strictly voluntary and participants were free to withdraw at any time during data collection; however, after completion of the data collection phases, there was no withdrawal option. All participants provided consent for research involvement in one of three ways: written, verbal or through an action such as agreeing to complete a survey.

Maintaining the privacy of research participants is paramount to protect their identities with respect to both confidentiality and anonymity. Confidentiality ensures that researchers could identify any particular participant’s responses and undertakes not to divulge their identity (Babbie 2007; Bryman & Bell 2011). Achieving anonymity occurs when researchers cannot assign any responses received to any individual participant (Babbie 2007; Bryman & Bell 2011). Initially, some of the data collected were identifiable. During Phase 1, interviews were audio recorded, resulting in re-identifiable data. Upon transcription, pseudonyms replaced any mention of the participant, school or researcher’s name,
therefore resulting in non-identifiable transcripts. Phase 2 online questionnaire included an option of opting into a prize draw at its completion, which required the respondents to provide an email address. When the questionnaire closed, download of data occurred with the email contacts stored in a separate file. After prize allocation and distribution, permanent deletion of the email file occurred prior to commencing analysis. Phase 2 survey data then became non-identifiable and was stored and analysed in that form.

Coercing participants to take part is also unethical; there was no reimbursement of expenses offered to participants in either phase. However, in Phase 1, each interviewee received a token gift to thank them for his/her participation, and two randomly selected recipients in Phase 2 received an eGift card.

Research monitoring occurred on a regular basis, the project supervisors ensured that research progressed adequately and complied with the conditions of ethical data collection. The project did not include any conflicts of interest, affiliations, pre-existing, or unequal relationships with participants. No participant had communication or language difficulty; all participants were fluent in English since they taught at a Victorian School. All participants benefited in that they and their opinions were of value to the researcher and the research environment.

Research results may be publicised in journal articles and utilised by academics, other researchers, education departments, schools and teachers. All collected data was safely stored and transported throughout the project and will be securely stored at Deakin University for a minimum of 6 years.

3.8: Generating and Verifying a Grounded Theory

The product of the Grounded Theory process described above is to create a theory. Emerging theory comes from combining densified core categories linked together with relationships, often defined in memos (Jones & Alony 2013; Lyons & Coyle 2007; Urquhart 2013). Researchers take one or two dominant core categories to focus the theory upon (Charmaz 2014; Glaser 1978; Urquhart, Lehmann & Myers 2010). Glaser and Strauss (1967) and Glaser (1978), recommend several criteria that theories and their categories must be - they are modifiable, understandable, fit for the situation, relevant, and work when put to use. The resulting theory should describe and explain the theory’s theme in a
general way but still be abstract enough to change over time (Glaser & Strauss 1967).

Grounded Theory studies have the ability to generate differing theory and model types - substantive, general substantive and formal (Glaser & Strauss 1967; Glaser 1978). Substantive grounded theories or models focus on ‘one particular substantive area’ obtained out of the data and are applicable to that particular situation; substantive areas build substantive theory (Glaser & Strauss 1967, p. 79). A formal theory or model can be generated from findings from multiple studies related to a particular category, built directly from new research, or from a substantive theory, and relate to a general conceptual area such as an idea, emotion, behaviour or relationship (Glaser & Strauss 1967). A general substantive theory sits in-between the substantive and formal, it is less particular than a substantive theory but not as abstract as a formal theory and is generated by expanding the substantive area focus (Glaser 1978). Moving from substantive to general substantive to formal theory requires greater abstraction, and possibly further sampling, analysis, and data or results from related studies (Lyons & Coyle 2007; Glaser & Strauss 1967). Figure 3.2 depicts a flow chart of the process of building theories in Grounded Theory, where the research can culminate in a substantive, a general substantive or a formal theory.
Glaser (1999) described the whole process as working through several levels to develop a theory through relying on discovery from the data, not on preconceived perceptions. The emerging theory needs testing and verifying or disputing by returning to the data or collecting new data and applying these to the theory (Glaser 1978; Glaser & Strauss 1967; Lyons & Coyle 2007). New data can consist of any data type, from any source, and of any size (Glaser & Strauss 1967; Lyons & Coyle 2007). Glaser and Strauss (1967) prefer both data types to verify a tentative theory and the clarity of its categories. Validation of Grounded Theory projects occurs through the processes of relevance, rigour, collecting empirical data, purposive and theoretical sampling, constant comparison, memos, and data saturation (Andersen, Inoue & Walsh 2013; Goldkuhl & Cronholm 2010; Jones &
3.9: Process of Grounded Theory for this Research

The outcome of this research developed a general substantive theory. By drawing on the above information, Figure 3.3 depicts the processes undertaken for Grounded Theory for this research project.
Figure 3.3: Process of Grounded Theory for this research
Research projects, no matter how carefully and thoroughly they are designed, can have limitations that may affect the overall outcome of the research project. This research project faced a variety of constraints and limitations; these were evident within the project’s choice of methodology, sampling and participants, instruments, and analysis.

This research project was the first-time use of Grounded Theory methodology, and although the greatest care and planning of the project occurred, the researcher’s development of Grounded Theory abilities is still in progress. As a result, inaccuracies, omissions and inconsistencies associated with Grounded Theory research, its stages and use may be evident.

The use of Grounded Theory, purposive sampling, and qualitative data introduced generalisation limitations to this project. Babbie (2007) and Williamson (2002) report that by using a non-probability sampling method the results may not be applicable to the broader population outside of those under investigation and findings cannot describe other samples.

Each of the two phases faced limitations in the sample size due to circumstances out of the researcher’s control. In Phase 1, an extended Australian Teachers Education Union industrial action affected interview numbers; while this was in process, members were not to participate in extra activities such as research. The use of a single researcher conducting all interviews may have contributed to interview bias. Even though the sample size was small and purposefully selected all the interviewed participants were from geographically dispersed schools throughout Victoria, showing that the problems raised were not a one-off issue and were widespread throughout other parts of the state. The use of unstructured or open-ended interviews may have been more appropriate than semi-structured interviews to gather grounded data. The semi-structured interview guides contained pre-conceived questions and even though multiple opportunities were available for open discussion, these may have influenced participant responses.

The number of questionnaire respondents for the second phase was far lower than anticipated and may have limited theoretical saturation; although still meeting the numbers mentioned by Creswell (2007) and Teddlie & Yu (2007) for Grounded
Theory and purposive sampling. The questionnaire introduction for Phase 2 included a sentence asking respondents to ‘spread the word about my research and this survey to other teachers’ as indicated by Glaser (1978), Williamson (2002), and Urquhart (2013). All responses were from Victoria, indicating that the magazine advertisement elicited none or very few responses overall, and limited the overall scope to one Australian state. Word of mouth seems to have drawn out more responses than the advertisement. Reviewing the questionnaire after data collection ceased has pointed the way to several shortfalls, questions for data collection should have included one to distinguish where respondents read or heard about the research. The time of year that the questionnaire was open was busy for teachers with end of year reports, assessments and reviews; the survey could have been open longer, at a different time of the year, used alternative contact methods or other means of distribution.

The research findings and analysis may have improved through a larger sample and collecting alternative data such as interval and/or ratio data to increase the opportunities for other statistical procedures; the small number of questionnaire responses limited analysis. However, Punch (2003) suggested that it was preferable to have a smaller body of good data than a large amount of poor data. Collecting both quantitative and qualitative data increased data richness and the use of multiple research methods and approaches. Pilot testing each stage, clearly labelling the questionnaire items and using a survey software package that reduced coding errors, assisted in overcoming other limitations in this research project.

### 3.11: Summary of Chapter 3

This chapter provided the details of methodology, methods and design for this multi-faceted research project. The above discussion has shown how multiple methods and designs relate to Grounded Theory research, how they were used in this project, and how they fit together to produce the outcome. Finally, the chapter described how the eventual small sample and data collected limited analysis techniques. The next chapter introduces the interviewees and presents the content of the interviews.
Chapter 4: Interview Results

In the global world of education, ICT tools have become a key factor in delivering education to students and in students learning experiences. However, what do ICT teachers think impacts on this situation? Continuing from the descriptions of methodological and design factors in the previous chapter, this chapter presents the outcomes of Phase 1, semi-structured interviews. The outcomes are set out in a similar order to the final NVivo Node structure (Appendix G.3). The chapter briefly introduces the participants interviewed and then presents the information collected in coded areas. The interview data was broken into small open coded sections, organised and labelled; the open codes then formed six larger selective coded categories (see Section 3.5).

4.1: Interview Participants

Introduction to the ten ICT teachers who took part in the in-depth interviews occurred in Section 3.6.1.2 Interview Participants and Table 3.3. Large variations existed between participants and between their schools. Differences were apparent in all aspects of demographic data collected, except that all participants taught secondary school aged students. The participants had a wealth of teaching experience with over 150 years in total (Table 4.1). Tables 3.3, 4.1 and 4.2, and Appendix F provide details of interviewed participants and their schools.
<table>
<thead>
<tr>
<th>Participant</th>
<th>Gender</th>
<th>Years of Teaching</th>
<th>Overseas Teaching Experience</th>
<th>Year Levels / Grades Taught</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elizabeth</td>
<td>Female</td>
<td>5</td>
<td></td>
<td>7 -12</td>
</tr>
<tr>
<td>Sarah</td>
<td>Female</td>
<td>10</td>
<td></td>
<td>7 - 10</td>
</tr>
<tr>
<td>Miriam</td>
<td>Female</td>
<td>5</td>
<td></td>
<td>7 - 8</td>
</tr>
<tr>
<td>Matthew</td>
<td>Male</td>
<td>10</td>
<td>Country not divulged</td>
<td>7 – 9, 12</td>
</tr>
<tr>
<td>Grace</td>
<td>Female</td>
<td>20</td>
<td>South Korea</td>
<td>7 - 11</td>
</tr>
<tr>
<td>Seth</td>
<td>Male</td>
<td>6 (Australia) 6 (Pakistan)</td>
<td>Pakistan</td>
<td>10 - 12</td>
</tr>
<tr>
<td>Simon</td>
<td>Male</td>
<td>42</td>
<td></td>
<td>F - 12</td>
</tr>
<tr>
<td>Abigail</td>
<td>Female</td>
<td>10</td>
<td>UK</td>
<td>7 - 12</td>
</tr>
<tr>
<td>Martha</td>
<td>Female</td>
<td>12 (Australia)</td>
<td>Asia, India, Singapore</td>
<td>7 - 10</td>
</tr>
<tr>
<td>Delilah</td>
<td>Female</td>
<td>26</td>
<td></td>
<td>7, 9 - 11</td>
</tr>
</tbody>
</table>

Table 4.1: Phase 1 interviewed participants teaching experience

4.2: Interview Findings

This section presents participants’ perceptions collected during the interviews into the six selective codes.

4.2.1: ICT Education

Computing education is necessary and important in today’s society, being ICT literate ensured that students were able to function in society. Simon said, ‘I think we would not be doing our students a favour if we didn’t focus on ICT as a learning component’, and Elizabeth suggested that ‘It’s more than just curriculum, it’s become life!’

4.2.1.1: The Compulsory Learning Years

- **Curriculum**

Participants’ were generally positive in their comments on the compulsory learning years’ curriculum. Elizabeth loved the fact that she could be flexible with the ICT curriculum ‘and you can really play with it’. Elizabeth could present the outcomes to reflect the ideals of students and that this curriculum level was
completely different to the expectations of the VCE IT curriculum. Abigail also enjoyed the flexibility of the ICT educational curriculum for younger secondary students, but admitted that the enormity and complexity of ICT meant that only ‘certain outcomes could be reached’.

Four of the participants were concerned about the curriculum deficiencies at their schools. Matthew and Delilah had concerns over the types of thinking not currently taught. ‘Computational thinking…logic…that just doesn’t seem to be apparent anymore’ (Matthew), and Delilah said that students were reluctant when it came to ‘sorting out the higher order thinking skills’. Grace thought that the curriculum was deteriorating, ‘I think it’s really fallen away across the state’, while Simon explained that in his earlier years of teaching no curriculum guidelines for special needs schools existed. ‘We had to cut and paste our own stuff from the regular curriculum documentation to try and fit our needs.’ Special needs schools cater for students with low intellectual capabilities.

Aspects of the curriculum content influenced students’ reactions to ICT. Delilah said that while most students liked the content taught, the programming content sometimes received responses such as ‘Oh I can’t do this, and I don’t want to’. Delilah commented that the school structured four topics throughout the year to keep younger secondary students more interested than when just using the Microsoft Office suite of programs. Although, on the other hand, not teaching Microsoft Office software caused Delilah some concern - she was aware of students not obtaining those skills, ‘We don’t teach basic Word or anything like that, which again is a worry but the kids will go, “I know that”, which technically they think they do but they really don’t’.

In those schools where the focus was on the Microsoft Office package, problems were evident. For example teaching the same package throughout the compulsory learning years created bored students, ‘They teach Excel and PowerPoint presentations in every year, students get bored and it doesn’t make sense to them anymore’ (Seth). Seth said that the curriculum needed appropriate planning to expand students’ previous skills. Simon iterated that ‘students get bored very quickly’ with continual word processing and Publisher use.

Participants Martha, Abigail and Grace suggested that including a variety of
material that was more up-to-date would be more relevant to students, ‘*maybe a little bit of programming such as app inventing or game programming, things that students can relate to and enjoy*’ (Martha). Abigail gave a similar comment. However, Grace included another factor, ‘*Of course, the medium itself has to move, what the students are doing outside the school in their own time has a lot of impact in the classroom*’.

Two participants, Seth and Abigail, described complete opposites when it came to improving the accomplishment of ICT education at their schools. Seth said that at his school the teaching of ICT was ‘*not very successful*’. However, a Year 8 elective offered to girls at Abigail’s school was making a concerted effort to change girls’ perceptions about computing. ‘*We introduced a program called Digital Divas and tried to make it as creative and as fun and collaborative as we could for girls only*’, they ‘*seem to be enjoying it*’. The aim of the program was to encourage more girls to choose IT in VCE. Abigail’s school also offered a second elective for any Year 8 students.

- **Years 9 and 10 ICT Electives**

Students in Years 9 and 10 can undertake ICT electives at most schools (Appendix F) however, the offering, uptake and focus vary. ICT electives were run in consecutive semesters for different year levels (Martha and Matthew), only in Year 10 (Seth, Grace and Sarah), in Years 9 and 10 separately (Elizabeth and Delilah), or as composite groups of Year 9 and 10 students in alternating years (Miriam). When discussing the uptake of ICT electives the number of student enrolments was important. Delilah eagerly replied that uptake of ICT electives was ‘*very good*’ at her school, and Miriam said that they had full classes. Meanwhile, Matthew and Seth commented that it was a struggle to make even a single class, ‘*We struggle, this year we have 13 students enrolled in IT in Year 10, but for next year we have only seven*’ (Seth). The number of students indicating interest, teacher availability, or elective content determined the frequency of offer. For example, ‘*If it was a very popular elective you’d be looking at say, two classes, I think that part of disinterest is because it’s fairly dated*’ (Matthew), and, ‘*They used to have one every semester and now it has reduced. I do not know whether it is because of teacher availability, or student numbers*’ (Martha).

The content and focus of middle years ICT electives differed considerably.
Grace’s school did ‘the good stuff with a bit of programming’; photography and filming at Delilah’s school; media, movie making, digital design, or IT offered at Miriam’s; game and web design at Elizabeth’s; web design and robotics at Matthew’s; and word processing and spreadsheets at Sarah’s. Electives were designed to attract students and give them a taste of other computing areas (Elizabeth), be creative and enjoyable (Delilah), or to ‘tune up some of the finer points that students should already have’ (Sarah). Students at Sarah’s school react with comments such as ‘Oh, do we have to do this again’.

Some students wrongly assumed that ICT elective content gave them insight into VCE IT. For example:

Elizabeth: When they get to the VCE side of it …

Researcher: Do they expect to come in and make games all day long?

Elizabeth: Well yeah! They rather have this wrong impression … not a wonderful view on what IT actually is.

• **Subject Naming**

Simon described how references to ICT occurred in the past at his school. Simon said that classes were called after what they did, ‘we used to go to the Computer class, or we’d go and do Word Processing’. Simon stated that the term, ICT, was not utilised until recently at his school and it referred to many computing areas, ‘it is sort of interchangeable. I know it’s now the default term’. Delilah’s suggestion of ‘it’s not information technology as such, it is more “Technology for Today” I suppose’ came about due to the variety of ICT content she taught to Year 7 students.

**4.2.1.2: The Post-Compulsory Learning Years**

• **VCE IT**

The offering of VCE IT classes was very limited. Participants were unimpressed with the VCE IT curriculum and its content. Grace and Elizabeth viewed Year 11 IT as very focused on business processes and theoretical applications. ‘The course itself in Year 11 is not greatly appealing … the content was very business oriented’ (Grace), and, ‘it leads a bit towards the businessy kind of stuff with a lot of theory, which is painful’ (Elizabeth). Martha also commented on a large
amount of theory present in the VCE IT curriculum.

Many current VCE units are inflexible, ‘there’s Software Development in Year 12, which has a lot more of your programming and stuff, but the whole thing is very stuffy with curriculum, which is an issue across every subject when it comes to VCE. There is this set curriculum and there’s not a lot you can do outside of that’ (Elizabeth). Matthew concurred with Elizabeth’s comments and criticised the VCE curriculum for its rigidness, ‘The senior school tends to get gripped by the VCE, its curriculum requirements and the amount of course content. The teachers tend to stick with what they know and are very resistant to change’. Whereas, Grace noted it as very slow to change, ‘I think it was interesting enough at the time but the content of those VCE IT courses never really evolved past that, it never really moved on as a lot of the other subjects did and so students started to not choose it’. Elizabeth was hopeful that the Australian Curriculum for senior students would address these issues and change VCE IT for the better, ‘Fingers crossed’.

Participants additionally thought that students viewed the content as unappealing, ‘The content doesn’t appeal to them, it’s fairly dry and different from Year 10, there you didn’t have to go into all the other detail of the VCE expectations’ (Grace). Delilah commented that when students thought VCE IT contained some Microsoft Office segments ‘they just go, “Nugh, not doing it”’ and they viewed the curriculum as boring ‘“oh systems development life cycle, boring”’, these opinions led to not selecting the subject. Delilah additionally suggested that the naming of VCE IT was a reason why students did not undertake these studies and thought that by calling it ‘Information Technology it comes across as being boring and old fashioned. We’re not doing Information Technology anymore, we’re doing technology, the IT course is still based on processing information and I think students see that as very boring’.

Not having qualified VCE IT teachers was an even greater problem than student numbers. Grace explained that the lack of VCE IT classes was probably due to no skilled staff to run it, and Matthew explained that they ‘don’t actually have a teacher qualified to teach ICT and so it’s not offered. There’s not sufficient interest, probably from the staff, more than from the students’. Matthew’s school was in a small rural area and he had attempted to set up distance learning for VCE
IT units for interested students, although, ‘there’s nothing at the moment’.

Schools each had its own criteria on student numbers to run VCE IT classes. One school would not run VCE IT classes unless there was a full class of students (Martha), while, others would run low numbered classes and/or combine year levels and units to make up a class (Elizabeth and Seth). No girls had studied VCE IT at Seth’s school in the past few years; he put this down to ‘most of the students doing VET and VCAL subjects’. Although, Martha used this reason as to why some students were doing VCE IT, those ‘who are not interested in many of the other subjects come to take IT’.

A lack of student numbers was the reason why some schools did not run VCE IT classes, ‘Not at the moment. We do not have enough students doing it’. (Sarah), ‘I used to teach Year 11 and Year 12 VCE IT but the numbers dropped and we don’t run it anymore’ (Delilah), and ‘I think they’re offered but there isn’t any uptake, it isn’t running’ (Grace). Grace did comment that student numbers in the past ‘were very large’.

Other reasons why students did or did not undertake ICT studies mentioned were interest, personality, and knowledge factors. Elizabeth cited that senior student interest ‘can vary hugely. You can get kids that have not studied ICT at all and decide, “I like computers but I don’t know much about them”’ and that ‘you really only get the kids that are already particularly nerdy, [or] who really want to do it because otherwise, their parents are going to make them do some other subject’. Grace thought that students had ‘decided they knew enough about ICT because they used [it] in their own homes and in other subjects’.

- **VET IT**

Of all the participants interviewed, Elizabeth was the only teacher who was currently involved in teaching VET IT. Elizabeth enjoyed the flexibility and freedom of VET IT teaching in comparison to the rigorous style of VCE IT, ‘I get to have so much more fun with that than you ever possibly could with VCE’. Even though the classes were fun for teacher and students’ she encourages the students to work hard and extend their abilities over and above what was expected. ‘I work out where they are and then I go “Alright, let’s get you guys beyond shall we?”’. Teaching in this manner, Elizabeth was hopeful that some students would
consider further computing studies, ‘I think that we’ve picked up more that would probably want to continue’. Seth was disappointment that VET IT was not currently running at his school ‘Not for last two years, we used to run it’.

4.2.1.3: Overseas Comparisons of ICT Education

During the interviews, four participants had mentioned they had taught in schools overseas. These participants shared their experiences and provided a comparison of how ICT education in Australia compared to elsewhere in the world. They described differences in the curriculum expectations and student aptitude.

Martha declared that in Asia, only top performing students would get into IT and that in India and Singapore students learnt various programming languages from Year 9. While, in Australia, Martha knew only a few schools introducing programming at that level, and ‘their programming doesn’t even have to work’.

Teaching overseas gave Matthew an insight into students’ potential. In his experience, ICT and components such as coding and web design were ‘taught explicitly as a subject’. Matthew noticed that the ‘the level of understanding and sophistication of students is very, very different,’ and that all students ‘had a much deeper appreciation for how the technology worked and what could be done with it’. Matthew described Australian students as capable end-users of technology and not as creative users, and that ‘they don’t really understand much about how it works’.

Abigail mentioned that the flexible structure of the compulsory learning years in Australia was very different to the standard set curriculum across all schools in the UK. Year 10 students all take the same exam in the UK and teaching involves teaching ‘into those exams’.

Grace taught English as a Second Language overseas in South Korea for a year and incorporated her ICT skills extensively in classroom projects. Grace noted that in her experience, teachers strived to and achieved great outcomes from students in all subject areas.

4.2.2: ICT Education Delivery Methods

The delivery of ICT education varied, although all schools incorporated integrated ICT teaching. The schools where Abigail, Grace, Elizabeth, Matthew, Miriam,
Seth and Martha taught relied on integrated teaching of ICT as the only method of teaching ICT to all students. Matthew stated that striving for one-to-one computing has driven the integration of ICT education at his school.

The three remaining schools taught ICT education in a combination of core ICT classes and integration. The core classes taught specific skills, with the use of those skills consolidated through integrated learning. Core subjects were for Year 7 (Delilah), Years 7 to 10 (Sarah), or for all students levels (Simon). ‘It’s a discrete subject area in Year 7. They have one lesson a week for an hour then it’s integrated into all the other subject areas after that’ (Delilah) and ‘At the moment we teach core at 7, 8, 9 and 10 for a full year’ (Sarah). Simon’s school would coordinate work from another class into ICT classes, ‘For example, if someone was doing wood work project then often the ICT class would support that by creating simple drawings as a guide, it wouldn’t have the finesse but it had the concept, which is important’.

At the time of the interviews, two schools were on the verge of achieving full integration of ICT. Sarah’s school was ‘about to change, we’re going to cut ICT classes back. There are too many other subjects not getting enough time, so this one goes’. While at Miriam’s school, plans were in place for ‘next year, we are looking that there would be enough computers to improve the student to computer ratio and assist with the integration’ of ICT education.

Participants were concerned about the limited or lack of teaching of separate ICT classes. Delilah was worried that students would have to fend for themselves after their first year of secondary school, as ‘we don’t teach IT after Year 7’. Martha and Miriam had recently encountered the removal of specific ICT classes, ‘I did teach it here for the last two years. It was a core subject at Year 8 only, it was the only spot in our curriculum that we run it and it was once a fortnight’ (Miriam).

Elizabeth and Grace declared that at previous placements, ICT was an independent subject. In Elizabeth’s first two years of teaching, ICT was as a ‘sole’ subject taught to Years 7, 8 and 10. Disappointment came to Grace when she heard that her previous school removed core classes, ‘I was quite happy, I thought that was quite a good program, two periods a week in Year 7 with IT. Now I’m not teaching at that school anymore, they’ve lost those two periods of ICT in Year 7 and it is really sad’.
4.2.2.1: School ICT Integration Planning Processes

All of the schools integrated ICT learning, however, the planning processes differed. Miriam’s school took the whole school planning process ‘It’s built into assessment tasks within their subjects’. Martha’s school took part in organised regular teacher team meetings to discuss curriculum aspects, ‘Every week we get together and discuss what we are teaching and what each person is to do and how to teach it, every teacher involves ICT in their teaching’. While Seth and Sarah’s schools used individual teacher planning, ‘It’s up to the individual teacher’ (Seth). A similar process occurred at Sarah’s school where she was solely responsible for interpreting the ICT curriculum, liaise with other teachers, and set tasks for students in Years 7 to 10. To avoid missing any details Sarah used a system of check sheets and made notes.

Elizabeth did not mention the planning process at her current school, although she sounded as if she missed the planning process at her previous school, ‘That school was fantastic at communication and planning, the entire Year 7 team would sit down together. I would know when to teach concepts. They were fantastic; I miss that school’.

4.2.2.2: Participant ICT Education Delivery Preferences

Following discussions on how the participants’ schools delivered and planned for ICT education, the ICT teachers imparted information concerning his/her individual preference for ICT education delivery. Martha preferred integrated only, ‘I definitely go for integrated ICT. I think it cannot be separated, it has to be within the curriculum’. While Delilah held the opposite opinion - of core only, ‘I think it’s more efficient being treated as a totally discrete subject’.

However, all the other participants preferred a combination of both class types. Abigail explained that each dealt with different aspects and were necessary, ‘both are vital, if I teach ICT in my own classroom we go into different scenarios, problem solve, and into the technological side. Where ICT across the curriculum is used more as a tool’. The need for a combination of individual core classes followed by application sessions was described by Simon, ‘There is a need for a time and place for teaching skills, specific skills, we can actually sit down and learn how to master them before applying it back into the classroom’. Elizabeth’s
second choice was for integrated only teaching because the use of a topic gave students a purpose of performing tasks.

A few participants envisioned that in the near future ICT core classes would return, for example, ‘I really believe that in a few years’ time they’ll go back to wanting some ICT specialist’ (Grace).

4.2.3: ICT Teachers

4.2.3.1: Participants First ICT Interest

Participants gained their first interests and enthusiasm for computing through a variety of means. Two participants had access to computers whilst growing up. Elizabeth came into the computer environment at a very young age; she described her interest coming from ‘just getting to play (on computers) at home when I was a kid’. Whilst Miriam’s interest in computers flourished during early adolescence at secondary school, ‘I’ve always had the interest through high school and carried that over’.

The remainder of the participants first encountered computers as adults. Abigail and Delilah accessed computers through the work environment, Martha through a short course with punch cards in India, and Simon, also through punch cards but whilst at university in 1974. Martha and Simon had experienced a long history of computing and had seen multiple changes in technology. Similarly, while at university, Sarah, Matthew, Grace, and Seth ‘first encountered computers or played with computers’ (Matthew). Matthew stated that his actual very first contact was through a programmable calculator in his final year of secondary school. Computer discovery for these ICT teachers began as early as 1974 and continued through to 1997 when Seth’s first encounter occurred. The participants all discovered that they had a natural flair and a strong attraction to technology, and relished them. Miriam got pleasure from ‘seeing new things’, Sarah liked the ease of information availability and contact with family and friends, and Abigail really enjoyed working with computers.

4.2.3.2: Participant’s Teaching Qualifications

Each participant’s pathway into teaching varied. All seven female participants plus one male participant completed formal teaching qualifications and had
studied computing related areas (Table 4.2). Participants declared that they taught diverse subjects (Table 4.2). Surprisingly, one male participant, Simon did not have any formal ICT qualifications, ‘the reason why I didn’t have ICT qualifications, there weren’t any being offered at universities, not in a formal sense’, although he had acquired ICT skills through other avenues, such as PD and ‘trial and error’. Miriam and Matthew did not specifically mention any teaching qualifications, and, Seth and Martha gained some qualifications overseas.
<table>
<thead>
<tr>
<th>Participant</th>
<th>Qualifications</th>
<th>Areas Studied</th>
<th>Mentioned Teaching Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elizabeth</td>
<td>Bachelor of Computing, Graduate Certificate in Education</td>
<td>Information Systems</td>
<td>Maths, IT</td>
</tr>
<tr>
<td>Sarah</td>
<td>Bachelor Degree, Graduate Certificate in Education</td>
<td>Computing Librarianship, Networks</td>
<td>History, IT, Geography</td>
</tr>
<tr>
<td>Miriam</td>
<td>Bachelor of Computing</td>
<td>Physical Education, ICT, Mathematics</td>
<td>PE, IT, Maths</td>
</tr>
<tr>
<td>Matthew</td>
<td>Bachelor Degree</td>
<td>Programming</td>
<td>Science, Environmental Management, Biology, Chemistry, Physics</td>
</tr>
<tr>
<td>Grace</td>
<td>Bachelor of Mathematics, Graduate Certificate in Education</td>
<td>Programming</td>
<td>Maths, IT</td>
</tr>
<tr>
<td>Seth</td>
<td>Bachelor Degree, Masters in Physics, Masters of Education, Post-Graduate Diploma in IT</td>
<td>Sciences Education Administration, IT</td>
<td>IT, Physics, Maths</td>
</tr>
<tr>
<td>Simon</td>
<td>Bachelor of Teaching</td>
<td>Special Needs Education</td>
<td>Multiple, ICT, IT</td>
</tr>
<tr>
<td>Abigail</td>
<td>Bachelor of Business and Technology, Post-Graduate Diploma in Education</td>
<td></td>
<td>ICT</td>
</tr>
<tr>
<td>Martha</td>
<td>Bachelor of Chemistry and Computer Science, Masters of Education</td>
<td></td>
<td>IT, Maths, Science</td>
</tr>
<tr>
<td>Delilah</td>
<td>Punch Card Course Diploma in Programming Languages, Bachelor Degree, Masters of Education</td>
<td>IT Online Learning</td>
<td>IT, Business, RE</td>
</tr>
</tbody>
</table>

Table 4.2: Participant qualifications, areas studied and teaching areas

4.2.3.3: Participants’ Professional Development Experiences

Discussing involvement in ICT professional development brought out a range of comments and emotions. Participants talked about attending sessions offered
externally and internally to their school, about their involvement in delivering PD sessions, and about sharing the knowledge that they had learnt. Abigail recounted the importance of PD for ICT teachers:

> Without professional development, I could not keep on top of IT for what is going on and how things are changing. There’s a big challenge when you work in ICT that you have always got to do some research, find out what the latest technology is, and try to keep ahead of the student and what are they using. Yes, so without that, then definitely you would be well behind.

Simon agreed and explained that ‘we will be left behind’ without ICT PD.

- **Externally Attended Professional Development**
  Externally run PD sessions were usually selected carefully, ‘for external professional development you need to have a core interest and if the school’s going to pay it’s got to hit one of their priorities. You need to make sure that your own professional development moulds within their goals’ (Grace). The expense of external PD limited the number of teachers who could attend, only ‘one or two people might go to a very expensive’ external session (Simon). Matthew hinted that he had limited chances to attend external PD due to his location; he would need to take at least a whole day to incorporate travelling time. Seth commented that he attended external sessions ‘mostly in my own time’. While Delilah, who teachers at a private metropolitan school found time and expense less of a problem, she could request attendance and continued on to say that her school supported its teachers regularly. The school had a ‘very good technology program. The expectation is for every teacher to do a program each year for something just in technology. Therefore, the students’ skills will build up over the next couple of years’. Martha often incorporated socialising with like companions when attending external PD sessions. These gave Martha and other teachers the chance to converse, which assisted in reducing the loneliness of being an ICT teacher. ‘Sometimes it’s hard here, there are not many IT trained teachers, but then when you attend you make friends. I met few teachers and joined a forum’ (Martha).

- **Sharing External Professional Development Information**
  Apart from increasing his/her own knowledge, school protocol expected that
teachers shared information learnt at external PD sessions. ‘I learn something and then I transfer the knowledge and share it with other staff members’ (Seth). Simon often went a step further when sharing information, he would arrange an after-school session for interested teachers and present the concepts learnt. Simon also found that others were very willing to share the information that they had acquired.

Sharing new information was not restricted to other teachers within the school. Participants would often integrate new concepts into the classroom as soon as they had learnt them. Abigail said she would ‘always try to bring back new skills and implement them into the classroom, or if I cannot see it in my own classroom then I will pass that information on to other teachers’. Matthew tried to get ‘the teachers to understand that they don’t need to be an expert in the software to use it in their classroom’.

Grace and Elizabeth expected that not all attempts to use new concepts in the classroom would work immediately. Grace explained that ‘If the PD is good and engaging, then I would attempt it straight away in my classroom. I usually take it back and explore it with the kids. I tend to be a bit more of a risk taker and happy to have some failures in the classroom’. Elizabeth would persevere to incorporate new skills into her own classrooms,

You go home thinking, “Oh I could do this and I could try this, I could try that,” and you come up with a million different ways that you could use it. I pull myself back a bit a say, “Okay let’s pick one class and we’ll try this activity and we’ll see how it goes,” and sit back and reflect upon it ... If it does not work you analyse why and you try again with a different class. Because it could be that, the problem was the kids.

• Internally Attended Professional Development

Comments made about internal professional development related to their level and timing. Grace vented her frustration on attending internal sessions; she acknowledged that they had limitations and that it was important to organise relevant PD opportunities.

Usually, it’s after school, very very boring, you’re tired, all you
want to do is get ready for your next day, and ahh, stuck in there in staff meetings and having to learn how to do one thing or another and that’s pretty hard. But then again there is not a lot of money for professional development outside the school so you can see how it needs to be in the school. Balancing your own personal professional development routine regime is important. Otherwise, you are stuck there at 4:00 doing professional development that is not satisfactory to you. The expectation is that you attend professional development within the school.

Elizabeth would prefer ‘to be shown things, “Here’s the list of different software, different websites you can use. Okay now go away and play with it.”’ Although, Elizabeth did understand that PD cannot cater for all levels of ICT knowledge at the same time. ‘The teachers, normal teachers, they need to be walked through little things, “Okay now go do this, now go do this.” “Okay I’m done, now what” “let’s get everyone else through it.”’

Seth was concerned about a teacher’s teaching load impacting on the time for individual PD, ‘teachers’ have enough teaching load and other duties, sometimes it gets really hard for them to have spare time to come and sit and learn the new things’.

- Delivering Professional Development

Almost all of participants interviewed had at one time conducted internal professional development. Miriam and Simon had run regular bi-weekly sessions for all staff at their schools, particularly when new hardware or software became available. Miriam commented that ‘we’ve incorporated a program this year where all the staff attends one session fortnightly to develop their skills’, and Simon, ‘we scheduled once a fortnight to get our heads around things’. Simon added that he ‘led many PD programs’. Matthew had a good laugh when asked about internal PD ‘Yeah that would be me running it’. Seth contributed to his school’s combined campuses PD days. ‘On student free days, I run PDs for all teachers at our campuses.’ Martha and Delilah had run sessions in the past but did not at the current time due to their teaching loads. Elizabeth was the only participant that refrained from running PD sessions; she said that she ‘avoids it and leaves it to the actual school technicians’.
4.2.3.4: Participant Responsibilities

Two participants had responsibilities that seemed to be far beyond their classroom teacher level position. Sarah, an IT teacher; was responsible for all of the IT issues at both the junior and senior campuses at her school (see Section 4.2.2.1). Elizabeth also was responsible for teaching ICT subjects to middle and senior school students despite her employment as a Mathematics teacher.

The remainder of the interviewed participants all held positions of higher responsibility (Table 3.3). For example, Matthew was accountable for ‘incorporating ICT use the classrooms, looking at developing curriculum, and aligning the school with the AusVELS curriculum’. Grace had a degree of technical responsibilities as well as supporting the integration of the ICT curriculum in the whole school. While Miriam assisted other teachers by simplifying ICT curriculum requirements, ‘I have helped with English and Maths subjects to break down requirements and to give them examples, such as website use and visual thinking’.

4.2.4: ICT Teacher Support

When queried on what types of support they encountered, participants gave information on providing assistance, receiving assistance, school networks and equipment support details.

4.2.4.1: Providing Assistance

All interviewees regularly assisted other teachers with using ICTs; some were happy to do this and others were not. Grace found that teachers sought her expertise more often once ICT became integrated and ‘that wasn’t too much of a problem, I could support the teachers, I was able to do that, I was quite happy’. Delilah and another staff member at her school provided support, ‘Yes, when they ask for support certainly. We have another gentleman here who provides a lot of support; he often will provide technology training’. In between the fortnightly sessions Miriam conducted at her school, she was available to clarify technological issues to teachers or to provide instructions.

Many of the non-ICT colleagues needed step-by-step instructions. Martha and Simon openly offered assistance through providing printed resources, verbal
assistance, and spending extra time with teachers out of school hours. Martha said she ‘Made an Excel sheet of questions and answers, and if they still had problems they could come and see me. I can go over it or stay back after school’. Simon would ‘Provide some instructions, have pages of print screens with little arrows, what to do next, what happens here, if this happens then do this, and if you’re in real trouble, just give me a call’.

Abigail and Elizabeth were not always pleased to provide assistance. Over the years, Abigail often assisted non-ICT teachers with ICT, ‘Yeah, (sigh) ... have done, yeah’, and Elizabeth portrayed a similar emotion

Yeah, I do that all the time. I am the “Go to Person” in my staff room, it’s so frustrating ... I do it on a daily basis, I try and ... I don’t just fix things for them. I try to explain to them why something is gone wrong ... We do have Education Support personnel. So there’s the main IT techie dude and a couple of other people, they are supposed to be the people you take the Laptop down to, or you can call them and they will come up, but they tend to ask me first in that I am more accessible.

At the schools of Seth and Matthew, there were also distinct people to go to for particular problems, ‘Depends on the type of issue, we’ve got a division of labour worked out. With all hardware stuff and some areas of software, people will go to the technicians. For areas of software that they are unsure of, they direct people to me’ (Matthew). Seth described that there was a ‘division of things’, with the network manager and IT managers taking on some of the queries, albeit that they were not located on his campus. Part of Seth’s role was to coach teachers in relation to ICT, ‘So my role as ICT coach is to help and facilitate teachers in terms of technology use in classrooms’. Seth saw two issues that affected his ability to do this job effectively; teachers had a lack of time to seek support, and that he was the only person at his campus that could provide support.

4.2.4.2: Receiving Assistance

The participants were very resourceful when they needed to find out something that they did not know. ‘I’d try to find it out firstly myself and have a go at it, then, I would speak to other teachers within the school or the IT administrators’
(Miriam). Abigail explained, ‘I would go to the school technicians, or if I knew the best person was in the Science department I would go to them. Of course, there is online, or to contacts I know elsewhere’. Grace understood about school technicians and their work,

*I have been in charge of each system in each school I have been in, and I know the back end problems and the stresses that go into it. The trouble is that a lot of the time all technical staff get is negativity from staff and students coming in, “Oh, this doesn’t fit,” “Oh, I’ve lost my work.” I totally understand that technical stuff can at times be a little bit uncaring, abrupt and things like that.*

Delilah and Seth used online or attended professional development to find out information, ‘Usually online, or if there’s a PD course being done by an advisor I would go to that as well’ (Delilah), and, ‘I could go to some PD sessions, online support, or self-study’ (Seth). Sarah admitted she was aware of her limitations, knowing little about ‘servers’ and being the only ICT trained person at the school. Sarah would often seek remote assistance,

*This new idea of doing everything by remote is funny, now my son is a techy over in South Australia and he does remote on my computer. I think this is just amazing, and then there is America working on my computer. Mind you, I discovered the difficulty with working on satellite in country Victoria; it does not work very well.*

Specific online methods were the preference of Matthew and Martha. To obtain information, Matthew headed to YouTube, ‘When I’ve got to use a new piece of software my first thought is to look at YouTube, chances are somebody has made a set of three-minute videos that will explain everything I need to know and I’m away’. While Martha values the forum, ‘I read the contributions, members exchange ideas, I haven’t contributed much, but if I have problems I can place it there’. Sometimes assistance came from the most unlikely sources. Simon became aware of the school’s inadequate electrical system when expanding the number of
computers, ‘And more to the point we had to develop electrical power point. I had to upgrade the circuitry because you can’t run 10 computers off one point with double adapters; it is dangerous and not appropriate’.

4.2.4.3: School Network and Equipment Support Issues

Throughout the interview discussions on teacher support, several mentions of school networks and equipment preparation occurred. During her many teaching years, Grace had been exposed to changing network issues, ‘Wireless is always an issue, sometimes it works and sometimes it doesn’t, sometimes it’s fast and sometimes it’s slow. The issues are changing with different mediums, but the reliability of the equipment, including the wireless, is always the key’. Seth had a heavy workload and left all network issues up to the network manager, ‘He looks at the network and technical things for the whole college’.

At some schools, network disruptions were common. In fact, immediately prior to the interview with Sarah the school network went down, ‘It’s the worst when we have an issue, you couldn’t get on. If it was down then that was just tough’. Sarah continued to complain about its speed, ‘the school’s system is very slow compared to students’ homes’. Other participants, such as Abigail, prepared a backup option, ‘Yes, there’s always disruptions in the network, you have to have a contingency plan. If you are working online and it crashes, you have got to have something else that you can work on or work with’.

System upgrades to accommodate the number of student Laptops had recently been undertaken. This was the first year that most students at Miriam’s school had Laptops, resulting in several reviews of the wireless network. Elizabeth’s school had worked hard at improving the network over the last few years. ‘They’ve really been working on it, our school now has over 1000 students plus 100 or something staff on the network, they really drove to improve it. Compared to last year, this year is so much better. It’s usually pretty damn quick.’

Both Grace and Elizabeth highlighted issues with scheduling the rollout of new hardware and software onto the staff and student machines.

When does the software have to be loaded onto student machines? When are technical staff notified? When do computer labs or Laptop imaging need completion so they actually run
The flow in the classroom is important and it relies on the quality of the image on the Laptops and the computer hardware (Grace).

Elizabeth detailed technician responsibilities as ‘everything is loaded on before they hand over Laptops. That takes a long time to roll out’. This discussion led to both the researcher and Elizabeth mentally picturing a room full of Laptops loading with software, and piles of Laptops waiting in the wings, and to this Elizabeth said, ‘Yeah, painful’.

4.2.5: Teaching with ICTs

An exploration into teaching with ICTs elicited information on the differences that ICT teachers make to students learning, advantages and disadvantages of teaching with ICTs, class preparation, classroom resource utilisation, and student computer access.

4.2.5.1: Making a Difference

Each participant had his/her own way of teaching that incorporated his/her personality, knowledge, and teaching methods. Many participants extended student learning beyond the curriculum requirements.

Grace aimed at extending students abilities to increase their interest and described that there was a degree of difference between non-ICT teachers and ICT teachers.

*The teacher makes all the difference. An ICT trained teacher is there because they’re engaged and have their own personal interest in the content, they bring all of that into the classroom with them when they walk in, and they bring in expert knowledge. They usually do not grizzle “Oh, this doesn’t work, and this isn’t working.” They find other ways to help students learn some of the theory without getting them to read the book and answer all the questions.*

Sarah was on a constant lookout for students who had high ICT capabilities so she could extend their knowledge. *I’ve got a couple of students in Year 8 that have wonderful potential, I’m also currently working on trying to get some of the Year 9s and 10s stepping towards the Year 11 and 12 stuff so that hopefully I can fast*
track them a little bit.’ Martha relished in keeping communication channels open and, like Sarah, introduced senior curriculum aspects to middle school students. ‘I know some kids who are in year 10 that say they want to do VCE IT, then I teach them a little bit of programming and multimedia in year 10 IT so that it will be easier for them.’ However, Sarah was disappointed that the school only offered one Year 12 IT stream. Matthew attempted to extend students abilities by questioning them to recall past activities and processes when introducing new concepts and software, ‘remember that thing we just did yesterday, think about how you figured it out, what is it you want it to do and think logically about where we’d go to find that command or to find that function?’ The varied curriculum content (see Section 4.2.1.1) and the way that Delilah taught it to Year 7 students must have been appealing; the students would query her on the absence of future core ICT classes.

Simon continually expanded students’ abilities to keep them interested and moving forward, ‘I think initially there was a motivational factor or a novelty effect, and you had to continually maintain that by teaching them something different and showing them new things’. Simon had used his own interests and initiated computing in special needs education in the early years,

There were very few computers around in special needs schools in those days, I think I had the only computer in my hometown; I would pick it up and put it in the back of the car. I used to visit the schools and bring the computer with me. You have to remember that the software was very limited; it was not necessarily educational, and if it was, it was drill Maths that you could print it out on bits of paper.

Clever and enthusiastic teaching approaches and perseverance seems to pay off; the teaching style of Elizabeth in her first year of teaching challenged Year 10 ICT elective students to make a web page step-by-step without using the web-design software.

I let them grab something they are interested in, in my first year of teaching, I had to teach web design and I wanted to teach them HTML from scratch. I used a projector and showed them
very slowly, tiny, tiniest steps. By the end four weeks, they all had a website that was completely different, yet the same, four pages linked together on a topic of their interest. It worked so well.

Provision of Elizabeth’s methods for senior VET IT students are in Section 4.2.1.2; she also adjusted the curriculum for students in lower levels to meet individual abilities. ‘You have to alter the curriculum to fit their skills, because you have to work out what their base level is, “Okay, well we’re actually starting in week five with my curriculum; okay let’s bump it all back and lets work out how we can extend the rest of the term.’” Elizabeth’s teaching methods also drove high VET IT class numbers where she had to limit the number of students. The researcher suggested running a second class Elizabeth replied, ‘that pulls me out of Maths and we’re really low on numbers in senior Maths teachers. It really messes things up’. Elizabeth said that the teacher taking the subject influenced its popularity, ‘A slight problem at our school is the two different teachers, depending on which teacher is going to be taking which subject. I am more popular than the other teacher.’ Elizabeth can relate this to her days as a secondary student, as an advanced ICT student herself, she can relate to student choices, ‘I had a fantastic teacher in Year 9 and 10 where he would give me some things that were twice as hard, three times as hard. He was more than happy to give me the more difficult, more complicated work’.

4.2.5.2: Advantages of Teaching with ICTs

Participants could see the benefits of integrated learning for ICT. Using the broad functionality of ICTs to combine learning across multiple subjects provided students with increased power over their learning choices. Students ‘get to see how useful the technology can be across all subjects, you can have all your homework and your assessment tasks up within the network, then they have access 24/7 to learning through using an online environment’ (Miriam). By using ICTs in teaching, Grace would involve other aspects of students’ lives into learning.

Matthew liked to teach with ICTs as it enabled him to teach at each student’s level,

If you are in a class where you have a broad range of abilities,
you differentiating to the class, you can be asking people to be looking at the same idea in different ways. They could look at YouTube or a website and learn that there are different ways of approaching the same idea. YouTube is the greatest thing since sliced bread for very visual learners.

Seth could see that using ICTs provided for a wider range of student learning types and made ‘the learning more visual. There are some software programs which are available, where the students can use to get hands on experience’. Martha concurred with Seth and described that ICT tools were suitable for ‘all kinds of learners’.

Simon noted that ICTs expanded the learning capabilities of students with special needs, with their work easily adjusted. Simon also said that ‘all of a sudden technology is now playing a bigger role in the education of a young person; it has added a new dimension to learning’.

Abigail said that ‘it can make a big difference’ with both students and teachers using iPads in the classroom. Abigail elaborated that using different programs such as ‘the Mirror App’ enabled her to

Display whatever is in [their] iPad on a projector or on the main computer and [the teacher] can walk around the room with the iPad and not be confined to the front of the room. They can see what other students are doing, and put the students’ content on their iPad onto the projector. The tool very quickly and very effectively lets other students see what is going on on other students’ iPads. It is a really good use of IT.

Miriam used a similar program on Desktops to interact with her students - ‘we have one computer classroom that actually brought up all the little screens of the students, it showed what was on each screen and you could physically interact and write them a message and help them out and show them things. It’s quite good’.

Two participants had hopes for the near future for integrated ICT use and teaching that was not yet evident in their schools. Delilah hoped that with integrating ICTs, student’s abilities would improve, ‘Yes. Well, we hope that will be the end result.’
Yes’. Coordinating teaching aspects within the school was Sarah’s aspiration.

I would love to be able to go and work with other teachers, for example, English, and get them to do a story line, I could then say, “Okay, I could get them doing Claymation on that,” and then take the story line that they have done, rather than having to get students to do another storyline in here.

4.2.5.3: Problems of Teaching with ICTs

- **Non-ICT Teacher’s Lack of Skills**

Several discouraging issues became evident during the interviews while discussing teaching with ICTs; most participants reported that non-ICT teachers’ just did not possess the knowledge to teach ICT effectively. Seth was worried about non-ICT teachers’ abilities at his school; they often only taught what they knew and had to. Seth described the lack of support for teachers to use ICT and suggested that possibly by ‘building teachers’ capacity to use ICT’ and utilising better ‘online learning, and integrating ICT across curriculum’ would help. Simon and Grace made similar comments on the inadequacy of non-ICT teachers’ skills. Grace said that non-ICT ‘teachers cannot be expected to know all of those things’ that an ICT teacher knows, and that non-ICT teachers lacked the ability to maintain their equipment appropriately and therefore were unable to instruct students how to do this. Furthermore, the newer qualified teachers ‘don’t have the general knowledge and skills of Umm, maintaining equipment’.

A lack of skills also affected the integration of ICT by non-ICT teachers. Miriam observed that non-ICT teachers needed ICT knowledge to understand how to break the ICT curriculum into smaller concepts. Miriam stated that ‘The disadvantage is that you need to have the skills first to show the kids how to do a spreadsheet, how to make an effective PowerPoint, or how to make a Blog; you need to have those skills first to be able to integrate with the subject’. Delilah stated that teachers who lack confidence would refrain from teaching the technological content, ‘The problem with integrating IT is you have teachers who are not confident. Their knowledge is not there, and it does not get passed down’ (Delilah). The integration of ICT into other subjects caused Sarah concern in that she often felt that the other subject’s content took precedence over any ICT
content causing it to be ‘missed’ out.

- **Teachers Confidence and Fear of Technology**

It was not only ‘the issues of [non-ICT] teachers keeping on top of their skill’ (Abigail), but also the lack of ICT teachers’ confidence and abilities that could jeopardise the teaching of ICT. Sarah confided that when ‘the kids know more than you do, it can make you feel very insecure and inadequate and that is a very scary thing’. Abigail noted that the breadth of ICT was a problem with regard to the teacher’s extent of knowledge, ‘You can’t expect to be an expert in everything, I haven’t got actual networking skills but I have to teach it. Some of these students have got parents in those industries and they know more than me, but that’s fine’.

Grace expressed a comment that seems to sum up the thoughts of the participants,

> Teachers struggle, a lot of teachers struggle. With the added burden of teaching the students how to use technology, the teachers stick to what they feel safe with, they feel safe with Word, PowerPoint and Internet searching, and so that is as far as they go. So in terms of the ICT down the track in Year 9, 10, 11 all you are getting is students that are already interested in those things, there is a lot of opportunities missed in the younger year levels.

Simon backed Grace’s comment in that he mentioned only a few years ago ‘There was difficulty for a lot of teachers, there was a bit of fear of the technology. There’s still a bit of anxiety’. On the brighter side, Simon said that recently he had noticed that for some teachers ‘it has become second nature’. Sadly, though, the dynamic nature of ICT had begun to catch up with Simon - he admitted he had limitations when it came to smartphones and said, ‘This Smartphone is smarter than I am, I haven’t mastered it too well yet’ while waving his smartphone in the air during the interview.

Sarah mentioned the fear of technology, she exclaimed that most of the teachers at her schools were older and that they found IT frightening and frustrating.

> They don’t like having the computers when they won’t work, they don’t know what they’re doing, therefore if the machine is not going and the kids know more than you do it can make you
feel very insecure and inadequate. It is a very scary thing to be left with a lesson plan that you have created and it won’t go.

- Other Limitations of Teaching with ICTs

It was not only the lack of teachers’ skills that affects teaching with ICTs, both Matthew and Grace divulged that the lack of a qualified ICT teacher at a school determined the teaching of ICT subjects. However, Simon and Sarah saw that limitations existed in solely focusing on using ICTs tools as an educational source. Sarah was concerned with the bigger picture, ‘we’re taking their big world and we’re saying, “Okay, squish it down, stick it in this box, and now you come in here and this is the way it works.” It’s not right’. While the personal opinion from Simon was that students missed other valuable learning opportunities,

*I think that is too narrow an education process if it is all stored on a Laptop, there is more to education than just computers. Other skills need maintaining or polishing up and not at the expense of just having technology taking over the whole thing.*

Time and preparation were issues for ICT participants. Elizabeth admitted ‘I’m not always prepared’ when supplying information for the schools online source in a timely manner. Abigail stated that when teaching with ICTs she had multiple preparation processes. Abigail not only had to spend more time initially setting up for classes including the setup of folders, worksheets, emails, groups, Blogs, and other online resources, she had to prepare a backup option. Although once achieved, it did save some time later on. However, Abigail said that ‘if the whole resource is online you know it does make you wary’.

The lack of ICT skills was not only with teachers’ and students’ (see Section 4.2.6.1). Grace expressed concerns for other educational employees, ‘Well that’s just sort of across the board, the school administration and the reporting systems, all of the online expectations of keeping your information and data’.

4.2.5.4: Classroom Resources

Interview participants supplied information about what classroom resources were available for students’ use to locate and review ICT education content. At Miriam’s school, students in her classes learnt their skills as they occurred and had no resources to refer to, although she mentioned that if students had a
textbook from the previous year, they could refer back to that. Whereas Sarah
used and provided multiple resources for her students, she incorporated class sets
of textbooks with introducing topics on the screen, slideshows, and class notes.
Most of the information was also available on the class website.

In contrast, at Elizabeth’s school, each domain made a decision on resources at
the end of the previous year. Some classes have chosen an eBook and others
textbooks and Elizabeth commented that this gave students good ‘experience of
both types of resources’. Elizabeth stated that students in her classes had on-line
access to learning materials, ‘there’s a book forum space, they can be messaging
me, they can get their own copies of worksheets and start working on it straight
away’, as well as additional worksheets through a free educational website.

Elizabeth could not understand why her school would not take up the Ultranet
(see Section 2.3.2.4) ‘because it is a fantastic idea’. [Note: The Ultranet was still
available at the time of the interviews.]

4.2.5.5: Computer Equipment in the Schools

Historically it was difficult for schools to obtain computing equipment. Simon
related back to the 1980s and 1990s when equipment was limited and it was
difficult to get funding. Simon said that the special needs school was given
redundant computers for student use from a large oil refinery (see Section
2.3.1.4). As the equipment became obsolete and replaced with newer models,
older ones were sent home with some of the school’s students, ‘at the end of the
day we thought we’ll just give them out to some of the students, they were very
happy to actually be given a computer’. The school continued to provide students
with older computers in this manner for many years. Initially, the school had a
computer in each classroom, and only later, a computer ‘lab was developed for the
purpose of teaching specific skills’. Recently the school began using Electronic
Interactive Whiteboards and preferred the use of Desktop Computers for the
students.

Like Simon’s school, Sarah’s school consisted entirely of Desktop Computers.
Some were in a single computer room, ‘Yeah, I do not like it like here [computer
lab room], we have an isolated room for computing ... but this is what we have ...
This is the only lab’. One-to-one computing occurred through additional Desktops
in small clusters around the school, ‘We’ve got a pod in the library and pods in a number of other classes’. Sarah had heard about portable computers for the school, although she did not seem certain they would arrive, ‘Got a Laptops bank coming ... that’s ... coming’.

A combination of Desktops and Laptops were in use at Miriam’s and at Matthew’s schools, although neither had reached a one-to-one ratio. At Miriam’s school they had ‘one PC lab still running, it is purely for IT’, a Mac digital lab, Desktops in the library and Laptop trolleys. Matthew’s school was in the process of converting from Desktop Computers to Laptops. They still utilised two computer labs and Laptop trolleys while the school moved to individual student Laptops, ‘now got devices almost right across the school. I think we’re on the verge where we will start with bringing your own device’.

Five schools, those of Elizabeth, Grace, Seth, Martha, and Delilah, all had Laptops, Netbooks, or Notebooks for their students. Three schools (Elizabeth, Grace and Seth) had reached one-to-one access through trolley sets or individually owned equipment. The remaining two schools were in the process of achieving one-to-one access. Only one school (Delilah) was beginning to bring iPads into use. The year following the interview, Year 7 parents were to supply iPads for their child to use at school. The other students would continue to use their current Laptop device. Teachers at Delilah’s school had already begun to use iPads. Appendix F displays each school’s student to computer access ratio and ICT equipment.

4.2.6: Student Learning with ICTs

This section reveals participants’ comments in relation to student learning with ICTs; it presents student learning styles, student engagement and attitude to learning, ICT tool use, and ICT career association.

4.2.6.1: Student Learning Styles

The participants taught in a manner that they hoped encouraged independent and self-learning, collaborative learning and self-paced learning. To encourage independent learners, Seth’s school provided students access to school facilities after hours where they could complete tasks they were not able to do at home, ‘We run catch up classes and study hall where they are provided with Internet access’.
Participants incorporated self-learning in different ways. When introducing new software to students, Matthew would encourage them to be self-learners, and when students seemed to be faced with the unknown, he would guide them ‘and let the students figure it out for themselves’. Sarah ‘worked on exploratory teaching’ where she let them ‘discovered things’. Elizabeth encouraged self-learning by providing access to information. Students at Elizabeth’s school could work individually through information provided on the schools ‘online space’. All students could ‘get online at school, at recess or lunch and have a look’ at what was coming up or what had been missed whilst absent from school. However, usually, those students with the ‘drive and interest in the subject’ would do this.

Some students would collaborate and problem-solve together, ‘that might not necessarily be their main outcome but they’re learning different skills in that as well’ (Abigail). Miriam described peer teaching as group discovery, ‘especially when they found something out really exciting and new, they want to show other students how to do it, and other students would want to know’. Sarah described that students would seek out the knowledgeable peers for assistance, ‘What we see a lot of is that kids know which kids are more able. You will have kids sitting and working and going, “Hey, so and so, how do I get this to do such and such?” They tap into those that they know; it is a sharing and cooperative environment’. Elizabeth agreed with Sarah, ‘You tend to find that the kids are more willing to help each other. There is always at least one standout student in the class that can show others how to do it’.

Abigail and Simon encouraged self-paced learning. Abigail provided access to information through preparing small video segments for students to work through, ‘I record mini videos, so they can do self-paced learning. Students are at different stages and they can start at different places and work on their own or in a pair’ (Abigail). Simon said that computers have made a difference to some special needs students. ‘I think there were certain potentials that came out that we probably would not see if it wasn’t for the computer.’ Students were able to ‘self-pace’ their work within their own ability, they ‘did not have to finish the exercise and they could go at their own rate’. Simon was always astonished at students’ abilities, ‘They surprised us with the things they could do, and it really pushed a lot of young people forward’. Simon recently met one of his ex-students in an
adult learning environment and the student had produced a large report on Egypt using a computer.

4.2.6.2: Problems Associated with Student Learning with ICTs

The participants identified multiple problems associated with student learning with ICTs. They complained about the lack of students’ fundamental skills and understanding of software components, ‘I know not everyone agrees with this but it really bothers me when kids can’t do what seems like really basic things. They sit there and go, “I don’t know where to start and which program should I use?” They do not make the connection with things previously learnt’ (Elizabeth). Matthew said, ‘They don’t think to carry that over past learning, and I suspect that’s the lack of depth of understanding of the technology’ (Matthew). Seth had similar concerns where students were limited in the extent of software application, ‘So for programs like databases or spreadsheets, they cannot create a visual example of work until they know how to use the software’.

There were few consistencies across the schools in relation to students’ ICT Literacy levels. Participants noted that in some areas students were ICT literate, while in others, they were not. Students seemed proficient in changing between devices, using gaming systems, and learning only what they needed to complete assigned work (Delilah and Simon). However, shortcomings were evident in students in relation to many of the basics such as spreadsheet development (Simon, Grace, and Delilah). Seth was adamant that at his school ICT Literacy levels were low and described that student improvement in ICT skills was progressing slowly. Seth commented that even though students had access to individual devices, it did not seem to make much difference and that those students who accessed after school sessions did not take them seriously. Martha commented that she could not make an assumption about students ICT knowledge, as she often was incorrect, and that it was important to teach basic skills before they left secondary school.

Sarah was concerned that integrated teaching missed the ‘the finer points, little things like setting your tabs, and what is a tab?’ Sarah added that she persevered when teaching students the basics,

\[ \text{Year 7s hate word processing, learning the basics are} \]
important. For instance, I try to have 15 minutes a week where we focus on the keys and typing practice, I already have them moving faster. I try to get them to understand that if they can improve this little bit it will make it better later.

Sarah also said that keeping students on task and concentrating on their work was problematic.

Integrated teaching is great, but kids being kids, they muck around and wander off anyway even when they haven’t got a computer in front of them. I find that kids work a little bit all over the place; they don’t sit down and work like they used to, they don’t sit down and stay focused.

Integrated teaching has its place; however, distractions occurred. Students would try to get Sarah to introduce them to other things such as ‘game making software, cartoon making software, and anything’ that distracts from schoolwork. Sarah began to separate the learning experience by using a general classroom across the corridor for reading and discussions and then move to the computer lab for hands-on. Sarah hoped that by doing this it would reduce student inattentiveness when in the lab.

Grace and Sarah both worried about student safety and behaviour while on the Internet at school. ‘It is an issue to keep them safe. The difficult bit is not being aware of where they are at any one time. They are no longer mucking around and talking with the person next to them. On their computer they could be mucking around anywhere in the world, doing anything’ (Sarah). Grace discussed that students were not proficient in ‘maintaining their Laptops to a standard so they didn’t have viruses’ and that ‘they should know about their privacy and their expectations when they behaved online, and about becoming good global citizens’.

Miriam and Seth noted that a lack of home Internet connection disadvantaged students, ‘A disadvantage would be no access to the Internet at home ’ (Miriam) to access documents from the school’s site. Seth said that many students at his school did not possess Internet or ICT tool access at home due to their socio-economic status. Seth added that this was not the only problem for his students;
most lacked ‘support from their parents’ and had other home issues.

Abigail was concerned because when teaching technology, students did not learn about ‘the impact of the digital footprint and what they were leaving behind’. Grace considered that students had a lack of good role models; she contemplated that ‘the only role models they have got are the technicians and that’s often fairly negative. All they get is, “Oh fix this, fix that.”’

4.2.6.3: ICTs and Student Engagement

The researcher asked the interviewees questions about connecting ICT tool use and student engagement. Miriam had seen the benefit of an online Mathematics program that increased her student’s enthusiasm for learning through ‘learning their skills through a hands-on approach’. Martha declared that ICTs do make a difference to student engagement and learning after trialling some software a few years ago. Martha had two classes, one using and one not using a computer and the software; afterwards students ‘told me this is helping them, some of the not very motivated kids, when using the computers understood it better’. The appropriate selection of programs by teachers for students increased their engagement ‘we’ve got a software program that teaches you how to type and it’s very graphical, there are lots of bright colours and it’s like a game really, they have to catch the letters or type the letters when they fall, and that can be very engaging’ (Abigail).

The visualisation and instantaneity of ICTs attracted students to learning,

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I \text{ think learning with ICT has grabbed the attention of a few more of the normally ill-attentive kids, the ones who do not want to read, cannot read very well or cannot be bothered. When you put it on the screen it can be coloured, it can be animated, it can be instantly right there without having to find it in the textbook and read it themselves (Elizabeth).}
\]

Matthew described ICT devices as ‘a hook to get students in and allow them to extend what they are able to do’. Matthew further explained that for country students to see the world without having to leave the classroom was a huge experience. ‘With Google Earth, you can get down on the street level and look around, it’s not as good as physically being there, but for students way down here
in country Victoria they get a feel for the experience of being there’. Bringing the world into the classroom was a view shared by Simon, ‘it’s more than just a computer it’s also sharing information. I set a task where every student has to give me an example of a news article that they found interesting from the Google news’. Sharing in this manner increased his students’ confidence, classroom interaction, and public speaking abilities.

Elizabeth said having an engaging task was as important as the tool used, she would open class discussion on a real topic and ‘what it is that they’re supposed to be doing and what the final goal is’. Elizabeth would then continue talking with them about how to achieve that. Task orientation had a big influence on student engagement. ‘It just depends on the task at hand and what the project is all about. ICT does help to engage but you have to go past the engagement and look for the actual real learning that is within it. The learning has to change, doing things differently, and getting the students responsible for peer to peer learning’ (Grace).

Just over half of the interviewees voiced that student engagement was partially dependent upon the teacher, ‘It’s up to the teacher’ (Simon), ‘it really depends on the teacher and what they are teaching. The teachers themselves, they’ve got to show enthusiasm for the subject, it’s not just one thing’ (Abigail). Martha ‘gets the kids motivated and involved, by showing them how to draw a graph by hand, and then in Excel’. Elizabeth displayed actions and deconstructed tasks and allowed students to ‘play with the options’ while performing an action to see how things worked. While Miriam suggested that constant supervision was paramount, ‘we walk around all the time and seeing what they’re doing and asking them how they’re going’.

In terms of engagement, Abigail commented that learning without ICTs can also be engaging, ‘I think that it can be very engaging but so can a lesson without ICT. I think really the ICT should be used as a tool and that you don’t rely on that just for the engagement’. Using a range of software such as ‘eduSTAR and the whole package of Microsoft tools’ assisted in engaging students and ‘help to improve their learning’ (Seth) (for eduSTAR see Section 2.3.2.1).
4.2.6.4: Students Interest in ICT

Student interest in ICT varied from none to complete fascination. Sarah had students’ with no interest at all in ICT, ‘A lot of students they’re not really attracted to doing anything in IT. There are a lot of kids here who cannot be bothered with a machine and would rather have their pen and paper’ to ‘A collection of kids that don’t see any purpose to a pen and paper anymore, “Why would I write, can’t we go and word process this.”’ Sarah said that the few very interested students at her school who were passionate about ICT would be disappointed that no senior IT subjects were available. Those students would most likely change to other schools or undertake distance education to study VCE IT.

Miriam confided that at her school there was increasing interest in learning while using ICT tools and that to keep that interest up you needed to make sure that the task was of interest to the students, though, and she had ‘to make sure that the students stayed on task’. Miriam added that keeping abreast of the technology increased student interest, ‘I think the interest is always been there for students to use technology and to be engaged and learning and seeing what’s happening in technology because it’s changing so often. Even in the last five years, it has changed so much’. Grace attempted to improve student ICT interest through other means, but to no avail, ‘I tried to get my technicians into the classroom to help talk to them about their viruses, about going online, all those things’.

Participants influenced students’ interest in ICT. For example, some of Elizabeth’s middle year students continued ICT study due to their positive experiences. ‘A fair few of them would have continued on their own but I think a few more of them decided, “Yeah, okay let’s give this a shot.”’ The students were hopeful that they would have Elizabeth again, although she said that, ‘I do know that quite a few of them did end up in this old guy’s VCE class’.

Differences in general interest levels appeared between students from regular secondary schools and those at a special needs school. Most students had high-interest levels in ICT study at Simon’s school; he found that ‘with special need school students, the kids love it, the kids love coming to the computers’. However, Simon did say that you had to challenge them and that variety was the key. ‘They must have some challenge such as digital cameras, particularly the easy to use
point and shoot movie cameras. Students had to learn the processes of putting it onto the computer, playing around with it, editing, adding a menu, a header and so on, that was very fascinating to them.

4.2.6.5: Student Attitudes to Learning with ICTs

Younger secondary students’ appeared to have more positive attitudes to learning with ICTs than older students do; many Year 7 students were eager learners, enthusiastic, positive, and had good ICT skills. ‘There’s a lot of wonderful eagerness in the Year 7s, they look forward to the stuff that we’re going to do’ (Sarah). ‘In Year 7 most of the students say to me, “why aren’t we doing it next year?”’ (Delilah). ‘The Year 7s coming to high school tend to know a lot more’ (Elizabeth).

From the participants’ perception, students had incorrect assumptions. Some students assumed that they knew all there was to know about ICTs, ‘they say they already know, but obviously, they don’t know a lot of things’ (Delilah). Elizabeth ‘shocked’ some of her senior students with what she could do with Excel; she commented that they said ‘“I thought it was only for tables and stuff”’. Some students believed that ‘it’s just there now, they say, “We will just look it up,” they trust everything that pops up. We’re working hard to get them to differentiate’ (Sarah). Some made no distinction between using and studying about ICTs, ‘there seems to be this odd perception that “I can use it, I don’t need to study it”’ (Elizabeth). Where others, complained about working offline, ‘“Uhh!” is that all I can do?” and “Oh my, gosh we’ve got to go find it.” They don’t seem to be able to think. They seemed to be switched on to the Internet’ (Sarah). Additionally, Sarah said that middle school students sometimes saw ICT learning as repetitive.

Several participants referred to some students as being just lazy. Delilah stated ‘but there are always students with a lazy attitude’. This attitude somewhat annoyed Elizabeth, ‘I am not going to say that’s true of every kid, but you still get a hell of a lot of kids that take the lazy direction. I have so many of them in my VCE classes, they are so lazy!!’ Elizabeth said that senior students’ lazy attitudes were not restricted to any particular subject and that convincing the students that they will need these skills (IT and Mathematics) in later life were ignored. Elizabeth continued to vent her frustrations,
They have to be the hardest audience to appeal to in an IT classroom. It is not as though they don’t care, they just want an argument. I’m still bothered by the lazy teenagers, the ones that, “Oh well, I know how to turn it on and I know how to type a document, isn’t that enough?”

Elizabeth gave her reasons behind why she thought that students take the lazy attitude. ‘It might be an age thing, I’m relatively sure they don’t know what they want to do with themselves yet, but it might also depend on what they have been exposed to, their home environment, or that up to Year 10 they’re expected to do so much curriculum work related to IT.’

**4.2.6.6: ICT Tool Use**

A variety of modern ICT equipment assisted students in their learning. Participants reported the use of equipment such as Desktop Computers, Laptops, Netbooks, Notebooks, iPads, cameras, Electronic Interactive Whiteboards, projectors, and sound and video equipment. These have ‘enabled them to produce and present stuff’ (Simon) individually and in groups (Miriam). Participants said that it was ‘how you use it as a tool’ in the classroom (Abigail), the breadth of things you did (Delilah), and combining technological and non-technological learning techniques (Miriam) that motivated student learning. Abigail noted that ‘if you let them’, students would bring what they do with technology outside of the classroom into the classroom, and that students were enthusiastic about technology in general, particularly if they can apply it to their own lifestyle and learning experiences.

Miriam said students viewed ICT tools as first, for fun and games, and then, for learning, but that depended ‘on which student you get and what direction they are heading’. Some students used ICT tools to take a more active part in learning by doing ‘things at home, especially if it was electronic, if you ask them to do homework, now they more likely would do it’ (Miriam). Others were ‘very passive users of the technology’ even within the classroom (Matthew). Matthew indicated that student passiveness came from the lack of ability to transfer prior learnt skills.

When discussing ICT tool use, Seth, Sarah and Miriam described gender differences or sameness. Seth commented that there was ‘a big gap’ - with girls
leaning towards music and online socialisation, and the boys concentrating on websites and games. Sarah noted that they were very different; girls tend to look at the aesthetics and creativity, while boys look at the content they can put in. However, Miriam had not noticed any particular gender differences with Year 7 students ‘No I haven’t, it’s not girls only or boys only, it’s just the general interest is there’.

4.2.6.7: Problems Associated with ICT Tool Use

With schools working towards one-to-one access and most students having individual access to computers, a new set of problems was arising. Abigail described that overuse of ICT tools could be a distraction, ‘if you used it all the time then I would assume that the students would get bored of it. You do have to vary things and not rely on that for engagement; you’ve got to put other things into it as well’. Grace expressed that,

> The issues are changing, they are much more around the Laptops themselves and that the students even bring them so they can do the class work. Often the students know they’re just going to be asked to do this pretty boring, dull stuff on their Laptop, “Oh I haven’t got my Laptop, I’ll just have to sit and watch somebody else do it on their Laptop.”

Elizabeth’s school overcomes this issue by stressing that students prepare daily for classes by bringing Laptops fully charged, and having their workbooks, textbooks, calculator, pens, and school diary. Students were penalised if they come unprepared. Getting students to take care of their Laptops can be a constant battle, albeit, manufacturers were taking this into consideration with batteries lasting for eight hours and coming with ’pretty heavy duty cases as students don’t treat them very well’ (Elizabeth).

4.2.6.8: Opportunities for ICT Career Association

The participants had very few opportunities to promote ICT as a career while teaching and stated that it needed to be age appropriate. Only three participants made comments on this aspect. Miriam commented that with younger students ICT careers would be referred to generically, “‘This is what we’re looking at today, this is how it is used,’” and not like “‘This is what a data analyst would do’.”
Miriam suggested that career association was more appropriate for older students. Whereas, Sarah would try to include ICT career information, ‘I have parts in the curriculum where we focus on where this is going to lead to, and what we’ll be doing in the future. I try to leave flyers around. We discuss it and I use videos that show career paths’. Despite class inclusion, Sarah was worried that the message was not getting through and that students had limited knowledge of ICT and careers. ‘It amazes me that kids do not see ICT as something you do in an office, they do not see it as an ICT career, and to them, a person working with ICT is just normal. When we discuss the fact when you are using a computer, is not that an ICT career and they sort of go, “Ohh.”’ Upon further discussion, Sarah replied that ‘They see bigger things that they think are beyond them such as major animation, movie making, computer-aided design, and graphic artists. Those things that are more than the everyday stuff that we do, they do not see that running a business from home needs ICT’.

Delilah also commented that students do not relate ICT use in media classes to ICT careers, ‘I think they see it as a totally separate thing. I think it is sort of, I think they see it as media as opposed to information technology, even though you are using technology. I think they just see it as, “oh well it’s different, its good fun”’.

4.3: Summary of Chapter 4

This chapter explored the comments made by interview participants in the semi-structured interviews and began by briefly describing the participants and then presented the findings in six separate sections. Each selective code described the comments made in relation to its topic. Interestingly, no participant contradicted any other in any of the issues discussed, demonstrating the commonality of issues that teachers from different schools were facing. The next chapter further discusses these findings and evaluates them based on if they were an inhibitor or enabler of ICT education.
Chapter 5: Interview Discussion

The previous chapter reported the ‘lived’ experiences of ICT teachers. Discussions of the selective codes described in Chapter 4 are now through three lenses: enablers of ICT education, inhibitors of ICT education and school differences of ICT education. The choice of these lenses assists in reordering the categories and determining the inhibitors of successful teaching of ICT. The interview content was then summarised into a tentative substantive model based on participants’ perceptions. Finally, the lenses guided the selection of two core categories, teachers’ ICT skills and teachers’ ICT PD.

5.1: ICT Education Enablers

This first lens of ICT Education enablers considers the successful components of the curriculum, the teachers, the students and equipment in this section.

5.1.1: ICT Curriculum Quality

Findings from this phase indicate that the participants considered the need for teaching ICT curriculum as essential. The perception was that ICT education was an important part of students learning, preparing them for life beyond the classroom. Current ICT curricula expose students to a variety of software to expand their skills. Interviewees relished the flexibility of the curriculum for the compulsory learning years; they enjoyed that they could introduce a wide range of ICT topics to students, and were happy that they could alter content to suit their students’ needs and interests. The only participant who taught VET IT welcomed its flexibility, which allowed the freedom to teach students higher ICT competencies (see Section 4.2.1.2).

Participants could see the benefits of delivering ICT education via integrated computer learning, which was first included in the curriculum in the Curriculum and Standards Framework (CSF) era (see Section 2.2.1.2). Integrated learning provided for greater flexibility when combining multiple learning skills across subjects, encouraged teacher cooperation in planning and allowed for different ways of teaching. Integrated learning using ICT tools made it possible for participants to have students work individually or together, collaborate on tasks, share learning by showing results, receive feedback and make alterations
immediately. Again, there was considerable variation in the way schools integrated the teaching of ICT, with no two schools integrating ICT in the same way, indicating the extent of school autonomy (see Sections 2.2 & 2.5.3).

Most schools also offered a variety of ICT electives, usually to middle secondary students with each elective delivered for one semester on a particular topic (see Section 4.2.1.1). The electives provided the opportunity to introduce students to new aspects of ICT, such as programming, or to revisit, consolidate and upgrade previously learnt skills. Participants commented that ICT electives, more often than not, included the aspect of creativity and that students seemed to enjoy this aspect. Student uptake of ICT electives varied between schools and was dependent on the teacher, topic and content, school timetabling, and how modern the topic appeared to be to the students.

5.1.2: Participants and their Teaching Practices

There were twice as many female participants than males in this study (see Section 4.1), a fascinating observation considering that males make up the greater proportion of employees in the ICT industry; this may be because, typically, teaching is a female domain.

Two participants (Simon and Martha), encountered computing prior to the 1980s, while the 1980s was a turning point in computer interest for others (e.g. Delilah, Elizabeth and Matthew). One participant, Simon, provided a personal historical perspective of computing in education; he became an early trainer of other teachers although he had no formal training himself and integrated computers into special needs education during the 1980s before it became the norm. This was not the first instance of a ‘self-taught’ computing teacher (Harris 2007, p. 89). No matter when participants’ computing interest first began, their connection to computing and technology was very strong. They held expert knowledge in their field(s), were skilled teachers, had terrific personalities, and were enthusiastic, passionate and strongly attracted to ICT education and the use of ICTs as tools in education (see Section 4.2.3).

This research found that participants enhanced the teaching practice and made a huge difference to student learning, they were innovative, engaging, enthusiastic, and made learning fun. These teaching attributes led to higher student interest in
ICT and positively affected students’ learning experiences. There was pleasure in hearing that an ICT teacher had to limit ICT class numbers. The same ICT subject offered, but taken by a different teacher, made a difference in uptake numbers, indicating that the teacher was an influencing factor on students’ choices (see Sections 1.1 & 4.2.5.1).

The ICT teachers’ enthusiasm increased students’ interest in ICT, the participants’ enjoyment of integrated computing teaching and the incorporation of ICT tools to problem solve and develop students’ skills in a global context. Participants encouraged students to become independent learners through different teaching styles, such as exploratory and peer-to-peer teaching (see Section 4.2.5.2). They persevered when teaching, learnt through mistakes, adjusted teaching techniques, provided simple instructions to students to produce the desired outcome and supplied tasks that were more demanding for students needing extension. Half of the interviewees were involved in expanding student ICT learning beyond the year level curriculum requirements. Participants aimed were to improve students thinking capacity, enrich student skills, give them a head start for the next year, and increase student interest with the hope that students would be motivated to continue ICT studies in the future. Participants were looking forward to future change, in not only the type of computing tools and how students access them but also to the impending new curriculum.

The interviewees were continually trying to build their knowledge base to overcome individual limitations. When it came to receiving support for technical issues beyond their current capacity they were particularly resourceful in seeking out and finding the information required. They would self-teach, seek out other knowledgeable teachers, research online, contact technical support staff, ask family members, and attend PD.

The participants’ PD activities included those sessions delivered within and external of their respective schools (see Section 4.2.3.3). They viewed them as opportunities to improve their own knowledge, to keep up-to-date with the developments in technology or to pass on knowledge. They felt strongly that PD content must relate to the curriculum, school expectations, and be relevant to teaching students. Participants would try to implement the newly learnt skills in their own classes soon after they attended sessions, even if they had not yet
consolidated those skills.

A few of the participants had the responsibility of running regular internal PD sessions; these were conducted for all of the school’s teachers to grow ICT capacity through introducing new concepts, building upon previous ones, and handling teacher enquiries. Some participants conducted internal PD sessions even though they had no formal ICT training. Non-ICT teachers saw the participants as a source of computing knowledge.

Interviewees viewed external PD sessions highly and benefited from them more than internally run PDs. Teachers of private schools had more opportunities to attend external PDs than those at public schools. ICT teachers chose the PD based on topic, content, knowledge level, relevance to curriculum, and the teacher’s individual need. External PDs provided participants’ access to other teachers in their discipline and the opportunity to build social networks and broaden ICT acquaintances. Interestingly, participants placed a large emphasis on sharing information learnt in external PDs with other teachers to expand the knowledge bank within the school.

5.1.3: Participants Perspectives of Students and Learning

Student engagement in learning was partially dependent upon teachers using different teaching styles and keeping a constant vigil on what students were doing in class paramount. Participants reported that students appreciated an interactive learning environment, with some being more motivated when learning with computers. Improvements in student learning occurred when using different aspects of technology, various learning experiences, building students skills, and involving interests from outside of school into the classroom. According to the interviewees, student attitudes to learning came from the schools, teachers, peers, home, social, and cultural aspects. These factors were similar to educational influences described by Hattie (2003), the OECD (2005), and the Working Group (1987) in Section 1.1.

Secondary students were encouraged by participants to take a more active part in their own learning through self-initiated independent learning and learning through their peers (see Section 4.2.6.1). Self-initiated learning was encouraged through exploration, discovery and information access, with students working at
their own level and speed, and catering for varying levels of student ICT knowledge. Peer-assisted learning involved students interacting with each other, assisting each other, collaborating, and sharing information. Participants acknowledged that students would know who were the knowledgeable students and would seek them out for details when needed. Classrooms were often a hubbub of noise during group learning sessions.

A student’s age and gender seemed to impact on his/her involvement with, and interest in ICT (see Sections 4.2.6.3, 4.2.6.4 & 4.2.6.5). Interviewees reported that most students still showed gender differences in what they preferred to do with technology. Boys’ interest concentrated on the content of technology with gaming, action, and designing (automobiles and websites) mentioned, while girls preferred the social side of technology with social media, communicating, creativity, and music prevailing. In a few instances, girls were interested in website design. Overall, younger secondary students had positive attitudes towards computing. In one instance, Year 7 students were concerned that they would not be doing ICT classes in the following years, indicating that they had a high level of interest in ICT. Some participants indicated that the preparation with ICT education concepts of many students entering secondary school was better than those of the past were; it seems that some primary schools were preparing students in ICT appropriately.

5.1.4: Equipment Access and Use

Schools utilised a variety of equipment (see Section 4.2.6.6). Many of the schools were in a transitional phase from Desktops Computer to Laptops, with Desktops in computer labs and computer pods, combining Desktops and Laptop sets, or having individual student access to Laptops, Netbooks or Tablet computers. This would indicate that the DER NSSCF and other computer equipment programs were beginning to reach schools (see Sections 2.3.1.2, 2.3.1.4, & 2.3.2.2). Technology advancement, reduced costs, multi-use, and the increasing volume of curriculum content contributed to the integration of ICT. The ICT teachers that had access to iPads enjoyed the freedom they gave to move around the classroom while using them and instructing students. The introduction of smaller lightweight computers and students’ individual access changed the mode of ICT education delivery.
Almost half of the schools provided 1:1 access for students (Appendix F). For those students with computer equipment and Internet access at home, they could access school assignments, contact teachers for clarification, search for information and lodge homework requirements outside of school hours. Irrespective of the tools used, participants described that ICT tools were a way to draw students into learning and a way of unobtrusively expanding students learning abilities while experiencing learning about the world around them. The nature of ICT tools meant that a diverse range of student learning levels and styles could be satisfied.

Students used ICT tools as a medium, which they could support their learning with and work independently or interactively. The tools assisted in encouraging students’ involvement in active learning and had a combination of uses for learning and entertainment. In some cases, ICT tools made things easier to do and were able to be used across the curriculum. They were not only for student learning but also as a motivator for learning; they provided an almost immediate response to their operation, gave a visual output of work in a clear format, and enabled easy editing. Student engagement increased with programs that had attractive visual content that caught their attention.

5.2: ICT Education Inhibitors

The second lens used to view the results of the study through was the inhibitors for ICT Education. These includes the less successful aspects of the curriculum, the obstructions experienced by the teachers, the students, equipment issues and non-school issues.

5.2.1: Curriculum Obstructions

Schools were inconsistent in what ICT they taught to students in Years 7 to 10 (see Section 4.2.1.1). This was dependent on the type of equipment available, access to the equipment, the experience of the teacher, teacher knowledge, the planning process, and its relevance to students. Participants’ commented that the curriculum needed to move with the times, and its structure and progression of skills through the year levels required some attention. An overcrowded curriculum restricted what could be included, and time limitations meant that there were few opportunities to promote ICT. The interviewees were concerned that younger
secondary students were not receiving basic ICT instructions, the level of ICT taught had dropped in Victoria, students were not understanding that ICT tool use could lead to ICT careers and did not relate learning ICT to careers in ICT.

A large number of subjects schools had to teach influenced how and when computing was offered and taught to students. This led to participants’ disappointment when core ICT classes were withdrawn. A lack of formal technology subjects caused participants concerns that students might only receive ICT instructions in their first and/or second year of secondary school, if at all, and had to self-learn other aspects as they progressed through their secondary years.

The ways that schools integrated ICT varied (see Section 4.2.2). Some schools integrated it right across the curriculum while others did so in only a few selected subjects. Participants saw some schools as successful integrators of ICT education while others did not; there was little consistency in planning and delivering ICT education with integrated learning, which was reflected in non-ICT teachers’ lack of ICT teaching and students’ lack of basic ICT skills (see Sections 4.2.2.1, 4.2.5.3 & 4.2.6.2). A further issue mentioned was that when integrated into another subject the dominant focus of the lesson was, naturally, on the other subject, ICT was solely a medium for learning. Half of the schools relied on integrated ICT only, creating concern that computing skills were not thoroughly included in teaching. Participants saw integrating ICT as beneficial; however, the lack of core ICT classes was an issue, with most participants preferring a mixture of core ICT classes and integrated ICT teaching. Interviewees reported that they considered that the flexibility of the curriculum was highly regarded, but it did have drawbacks with inconsistencies existing between schools. Even though the integration of ICT is in the curriculum and learning outcomes, one participant called for more interactive learning at the school.

Middle secondary school electives topics varied (see Section 4.2.1.1). Differences were evident in the electives on offer and their frequency and uptake by students. Overall Year 9 and 10 electives were not very popular, with the type of school, its geographical location, teacher availability, the teacher taking the class, the teacher’s knowledge, the topic of the elective, or the students’ perceptions influencing the numbers. One participant reported that low numbers for the elective offered were due to an outdated curriculum. The most popular ICT
electives were those related to Media. When student numbers of ICT electives became too low to run the class, the class was withdrawn, leaving an educational gap in the pathway to senior ICT studies. ICT electives covered specific aspects of ICT and showed students what else ICT could encompass, and participants believed that the electives gave students an altered perception of what they might expect in senior ICT studies.

The participants were not complimentary about the VCE IT curriculum (see Section 4.2.1.2). Not one interviewee made a positive comment about its content. They described it as restrictive, rigorous, stuffy, outdated, inflexible, boring, too theoretical, repetitive, unappealing, old fashioned and very business oriented. They also reported that the set curriculum had not changed considerably over the years, it did not leave room for modification, and the labelling and content descriptions provided to students were not interesting. A thorough overhaul of VCE IT was called for with updating content, keeping up with technology advancements, and the inclusion of some flexibility.

The few participants that had worked in schools overseas reported differences they had noticed in relation to ICT education (see Section 4.2.1.3). When comparing Australia to that of overseas countries, these participants described Australian schools as lagging behind in ICT education. The major differences were that students overseas were more aware of technological capacity, their technical depth and understanding were at a higher level, and that all students began programming from at least the beginning of secondary school. Another issue brought up was that in some countries only higher achieving students had permission to study senior ICT subjects.

5.2.2: Teacher Hindrances

Participants recognised their own limitations and that the dynamic nature of ICT contributed to the problem of keeping up-to-date with information. Participants mainly mentioned the amount of time they devoted to preparing for classes and that sometimes due to time restrictions these were not always finished (see Section 4.2.5.3). Preparation activities not only included what was for class use but also the online resources for electronic submission to the school’s online site, which made at least one interviewee wary. Insufficient preparation time seems to
be a common complaint of teachers (De Bortoli 2014).

There were concerns from participants about the knowledge level of basic ICT skills of non-ICT teachers and, hence, integrated ICT learning (see Section 4.2.5.3). The interviewed participants all commented on the number of times they assisted non-ICT teachers in relation to basic ICT skills. Some were quite annoyed at constant interruptions and the time they took to resolve problems, often involving systematic instructions and providing additional resources (see Section 4.2.4.1). The extent of disturbances indicates that non-ICT teachers’ skills were insufficient to meet their own needs and that of their students and that they were ill prepared to deliver ICT curriculum in an integrated environment. The issue of the lack of ICT skills amongst non-teaching staff also became evident during the interviews, such as administrators coping with data security.

The interviewees indicated that some non-ICT teachers had low confidence and feelings of frustration, anxiety, insecurity and inadequacy with ICT (see Section 4.2.5.3). Some participants held concerns that non-ICT teachers struggled with basic skills in ICT. They did, however, recognise that it was not the expectation of non-ICT teachers to possess the expert knowledge that they held. Some non-ICT teachers and schools tended to remain with the same programs and teach the skills that they were comfortable with, such as focusing on Microsoft Word. Without the skills or confidence, non-ICT teachers were severely restricted on how much ICT knowledge they could pass on to students.

Lack of interest in ICT by non-ICT teachers could possibly be partly due to lack of skills. Two specific skills mentioned that some non-ICT teachers lacked were teaching different types of thinking and the inability to separate computer tasks into smaller manageable sections (see Section 4.2.4.1). The wider the variety of computing skills possessed by a teacher, the more confident they become to pass information on to students, resulting in informed students and fewer interruptions to ICT knowledgeable teachers.

It was interesting to hear that there were still teachers frightened of technology in today’s technology rich world, despite computing having been included in the school curriculum since 1987 (see Section 2.2.1.1). Non-ICT teachers had fears of coping with technology; concerns about what to do when things went wrong, and
a fear of not being able to pass on a positive image to students when they did not possess it themselves (see Section 4.2.5.3). The fear associated with technology could be contributing to a lack of ICT skills in non-ICT teachers.

Schools varied in their approach to ICT PD (see Section 4.2.3.3.). A few schools had regular internal sessions for non-ICT teachers run by the ICT teacher, while most schools did not. This leaves the question of how ICT teachers built their hours of PD. Some of the interviewees were happy to conduct internal sessions while others were not. When asked about PD, one participant requested that the educational authorities should build ICT curriculum development activities through supported online learning modules.

Attending internal professional development did not receive any positive comments from the participants (see Section 4.2.3.3). They complained in the interviews about internal PD sessions not meeting their needs, and that the content focused on the needs of non-ICT teachers, which was irrelevant to them, unstimulating, and a waste of time to attend. However, they were accepting of the fact that non-ICT teachers need to learn as well. Not only were internal ICT PDs not meeting the needs of participants, they may not have been meeting the needs of non-ICT teachers as well, as reflected in the complaints about non-ICT teachers’ lack of skills.

Participants viewed external ICT PDs as highly beneficial, although the ability to attend such PD was limited. They commented that their teaching load affected their time to attend external ICT PDs, with some having to attend on weekends. Other issues that affected attendance were a distance of travel, cost, school size, and school priorities to consider.

Participants’ sometimes found it difficult to get assistance and resorted to a variety of means (see Section 4.2.4.2). At one school, the interviewed ICT teacher was extremely concerned about the complete lack of support for both ICT and non-ICT teachers. Not all schools had technical support staff available; this made it more difficult (Appendix F). Mostly, it was up to individual teachers to build his/her own knowledge when using ICTs in the classroom. In those schools that did have the technical personnel, often the attitude and mood of technical personnel were unpleasant as they became annoyed with constant student
complaints. Technical staff were also there for teachers to access, although this was very limited due to the number of students seeking assistance with equipment problems; some teachers were reluctant to seek assistance and instead sought help from other teachers or students.

Four of the participants were the one and only IT trained staff at their school and one school had no dedicated ICT teacher, thus limiting offerings of ICT classes. The participant’s individual knowledge areas and availability determined what subjects and electives were on offer. In one case when a participant changed schools, core ICT classes were discontinued due to no ICT trained teacher availability, confirming that there were not enough qualified teachers to meet the need (Dodd & Parker 2014; Maio 2016), and that teachers were teaching out of their field of expertise (see Section 2.5.5). This participant was disappointed and commented that students would most likely miss out, as student instruction would be limited to non-ICT teachers’ knowledge.

The diversity of responsibilities among the participants did not always reflect their employed position (see Section 4.2.3.4). Often, interviewees had to perform duties beyond their employed position, from dealing with network issues, teaching on other areas, supporting non-ICT teachers, and designing class content from the curriculum for other teachers.

5.2.3: Perceptions of Student Skills and Opinions

The use of ICTs may have improved some students’ attitude, attention, engagement, skills, and interest in learning, but this was not always true. Interviewees complained about students’ lack of ICT skills (see Section 4.2.6.2). A variety of ICT skills were included and taught; nonetheless, few non-ICT teachers focused on primary skills. Students were not attaining basic skills, probably because non-ICT teachers did not teach them, did not have the time to teach them, or lacked the skills themselves to teach them. Students’ lack of the most fundamental skills affects the success of ICT education.

The lack of students’ fundamental skills annoyed the participants; students at some schools were learning other skills at the cost of not learning more basic skills. The following examples explain the lack of basic skills:

- participants complained about students’ online safety, their use and behaviour
whilst on the Internet

- students lacked insights into software components, and how and where to find them
- students were unaware of what program to select to perform a particular task
- students had problems when it came to transferring skills from one program to another when learning new things they did not join the dots with past-learnt information.

Every interviewee definitely agreed that students should be ICT literate by the time they leave school, but the question of whether this occurred received different responses (see Section 4.2.6.2). There seemed to be differing views of what ICT Literacy was and how to achieve it. ICT Literacy varied greatly; participants perceived that the students thought that they were ICT literate because they could use a computer for what they wanted to do. Providing the basic skills was difficult as students were at different levels and came with different skills. At some schools, ICT Literacy was a real concern; a few participants were concerned that students were leaving school without achieving sufficient ICT Literacy levels. Participant comments in relation to students’ ICT Literacy were comparable to the NAP - ICTL results in Section 2.4.1.1. One interviewee talked about how students’ learning progress in ICT Literacy were still slow even with individual access to ICT tools.

Participants said that some students had low concentration spans, and had trouble staying on a task to complete it (see Section 4.2.6.2). Overall students’ attention span did not seem to improve with the use of ICTs; students would use any excuse to veer away from schoolwork and would try to take the easy way out of doing classwork. Some participants described students who worked all over the place, talked about non-class issues, did not sit down, and could not stay focused. Participants mentioned that a combination of things would improve student engagement (see Section 4.2.6.3). These include up-to-date equipment, a knowledgeable teacher, appropriate tasks, and retaining student attention and interest through an engaging curriculum.

As would be expected, different students have contrasting levels of interest in ICT (see Section 4.2.6.4). Student interest varied from those with little or no interest to
a few completely absorbed in ICT. Very few students were passionate about ICT. The interview results depicted students’ interest level in ICT decreasing as they progressed through secondary school - younger students seemed more interested in learning ICT than older students. In year 7, some students were highly enthusiastic, but throughout the middle years, interest already waned, this was reflected in the frequency (or infrequency) of computing elective uptake and offer. By the senior years, interest drops considerably (see Section 2.4.2). Students’ lack of interest in ICT were explained as results of negative experiences from previous teachers, geographical location (country kids), lack of skills, and perceiving the wrong image of ICT through lack of beneficial role models.

Students learning attitudes were a major concern to the interviewees; students assumed that because they had used a particular program that they knew all there was to know about that program (see Section 4.2.6.5). The participants said that student attitude was one of ‘been there, done that’, or was that a way of trying to get out of the set task and taking the lazy way out. Previous teachers and experiences influenced students’ attitudes both positively and negatively.

Current students at secondary schools in Victoria have grown up in a world of high technology use. Participants divulged that today’s students were very reliant on the Internet and expected immediate access to information and for it to be on hand at all times. They added that students had little concern over the source or authenticity of that information (see Section 4.2.6.5). Some participants reported students as capable end users, but they assessed them as not very capable creative users of ICT (see Section 4.2.6.6). They expected students to be more self-learning directed but some were not.

Interviewees had concerns about senior students’ preparedness for VCE IT and that it varied greatly. No prerequisites exist for VCE IT while for other subjects, such as English and Mathematics, students undertook prerequisite studies in Years 7 to 10. An interviewee suggested that VCE was too late to introduce ICT as a separate subject and that this should be introduced in lower secondary levels to get students interested in ICT. Most senior students’ did not regard senior IT studies too highly. The interviewees said that:

- fewer seniors were choosing IT studies, a participant who had taught for 20
years noted that there was a large drop in numbers over those teaching years

- class sizes varied at different schools, with some schools struggled to make the numbers
- fewer schools offered IT subjects, less than half of the schools offered senior IT subjects
- IT was perceived as hard
- other subjects and study options often took precedence.

The availability of trained ICT teachers, school timetabling, staff interest, and the perceptions that there was no work available in this field further hampered senior student selection of VCE IT subjects. However, despite these problems, participants and their schools were trying to keep senior VCE IT subjects going to the extent of combining senior year levels. Additionally, a lack of interest in other subjects was sometimes an incentive for a few students to undertake senior IT studies.

5.2.4: Equipment (In) Applicability

Multiple comments from interviewees related to keeping equipment up to date to enhance student learning (see Section 4.2.6.7). Technology changes quickly and every few years newer equipment is needed (or wanted) to ensure that students were receiving instructions on up-to-date tools. Participants remarked that there were issues with students and ICT tool use, maintenance, treatment and storage. Some non-ICT teachers were not competent users or effective integrators, were unable to contend with breakdowns of different technological tools and found it difficult to alter lesson delivery quickly. In schools where the transition to individual student computers was underway, the number of and access to computers determined the extent of ICT integration and in what classes this occurred.

Some participants viewed that using computer equipment was not always the guiding factor to student engagement, even though students had one-to-one access and some students flourished, others floundered. There were participants who considered that using ICTs as the dominant teaching focus was a limitation for students. They thought that overuse could be distractive and that learning could
still be engaging without the use of ICT tools.

When discussing equipment, the issue came up about resources schools used (see Section 4.2.5.4). Overall, ICT textbooks were not widely used, a few schools had sometimes utilised class sets of textbooks, while the remainder did not have an assigned textbook. The expectation was that students relied on their own notes and memory, the school’s online space, or went online to search for the needed information. Although some schools used non-electronic resources, many schools relied heavily on electronic resources.

A further school issue brought up by interviewees was the school’s network infrastructure (see Section 4.2.4.3). Network issues annoyed the participants; they mentioned problems such as unreliability, speed, landline, satellite and wireless limitations, system dropouts, and network systems adjusting to one-to-one computing. These problems occurred in all schools, no matter their location, although some schools were working on improving network issues to accommodate more devices. Participants discussed the effect of network issues on class preparation and the extra time needed to prepare alternate class work that did not require an online presence to adjust classes quickly. Participants learnt to take dropouts in their stride, while students would question, query, and complain about a lack of connectivity.

5.2.5: Non-school Impacting Issues

Two of the interviewees disclosed that social, financial, home and family issues made an impact on students and their use of and interest in ICT tools (see Section 4.2.6.2). Interestingly, secondary students in country regions had more interest in outside of school activities than they did with technology. These students preferred to be doing things in the outdoors, such as sports or possibly assisting the family on their property, more than sitting down with ICT tools. A participant indicated that because of the socio-economic climate of the school, students were disadvantaged due to the family’s low financial status. This affected their homes connecting to the Internet and the students’ access to the school online site and to homework and other class information. Additionally, this participant said that the students had minimal support from their parents for schoolwork and use of ICT tools, possibly because the parents did not have the time, knowledge or interest in
their children’s schooling.

5.3: School Differences of ICT Education

The third lens views the study results via the differences between schools. Large discrepancies became apparent between school size and type in relation to the curriculum, planning methods, support, ICT classes, and ICT tool access.

Successful teaching of the ICT curriculum varied between schools and depended on factors such as student attitude, family influence, the school, teachers, student knowledge, and the curriculum itself. An explanation for curriculum variance is the inclusion in the curriculum framework for schools to have the flexibility to construct programs related to the needs of local students (see Sections 2.2 & 2.5.3). The interviewees were hopeful that the upcoming national curriculum would overcome deficiencies in the current curriculum. Some of the issues reflected on included:

- the curriculum to move with technological change with more regular updates and incorporating up-to-date issues, such as the current explosion of Apps
- the inconsistency of student skills
- providing more challenging issues to students, such as introducing simple programming
- ensuring successful progression of skills learnt throughout all year levels.

The flexibility of the compulsory learning year’s curriculum had a positive impact on participants; however, there seemed to be no basic guidelines on the planning and delivery of ICT education. A large public secondary school incorporated team meetings; a medium private school used a whole school approach, while a large public and small private school used the individual teacher approach. The successfulness of integrated ICT teaching varied and seemed to depend on the schools’ planning process; the team and entire school approaches enabled discussion between multiple teachers where coordination between subjects of ICT integrated concepts would occur.

Two small schools had no technical staff on site for support; at these schools, the interviewees were responsible for all ICT issues, although, if they were unable to solve the problem there was assistance available through the phone and the
Internet (if working) from the education department and other sources. On the other hand, medium and large sized schools had technical staff on site or available at one of their school campuses, and problems could be dealt with quickly. Additionally, those schools with multiple ICT teachers and technicians had other like-minded staff members to turn to for knowledge and support.

Two of the private schools taught ICT as a core subject, and the public special needs school had core ICT classes for all students, while no secondary public school taught ICT in this manner. In one instance, ICT core classes were about to be removed to accommodate other school subjects, and all schools incorporated integrated ICT. As described in 4.2.1.1, middle school ICT elective topics and numbers differed with some schools electives more popular than other schools. Of the five schools that mentioned uptake numbers, two private schools with media related electives had good numbers, while three public schools with varied topics described the difficulty in making up class numbers. Students at four large public schools undertook senior student ICT classes, of these, one offered both VCE IT and VET IT while the remainder some or all VCE IT units. No private school or public school of medium or small size offered any senior IT studies despite almost all schools interviewed having at least one ICT teacher.

No small or medium sized school reported achieving 1:1; however, they were in the process of working toward achieving a 1:1 student to computer ratio with each school at a different stage (see Section 4.2.5.5 & Appendix F). These schools relied on Desktop Computers in computer labs, small pods, classroom placement, or class sets of Laptops on portable trolleys; only one school had individual student computers for some students. The students’ at all six large schools had access to Laptops, Netbooks or Tablets, four of the schools had achieved 1:1 access and two were in process of achieving this standard. Reaching 1:1 access to computing tools determined the extent of ICT integration in schools. As tool access increased so did fully integrated ICT education. At the five large public schools, no core ICT classes existed, whereas in the large private school they did. No school had yet begun a BYOD program (see Section 2.3.1.5), although one medium public school was considering its introduction.

Participants from the public secondary schools were concerned over junior students not having core ICT classes; issues such as timetabling, a crowded
curriculum, expected integration of ICT, trained teacher availability and access to technical personnel affecting core ICT classes. These interviewees reported they needed time to teach specific skills and to incorporate different types of thinking into their classes. Most participants preferred combined ICT education delivery methods consisting of both core and integrated classes (see Section 4.2.2.2). Descriptions of core classes included teaching students’ basic and specialised skills and technical aspects while providing students time to practice those skills. Integrated classes with ICT could then follow these classes where students could apply the learnt skills in a meaningful manner. In the interviews, the participants mostly viewed ICT tools as a method to complete other classes’ tasks without much consideration for ICT content. Problems associated with integrated ICT teaching without the presence of core ICT classes meant that all teachers teaching with ICT tools would require both generalised and specialist ICT knowledge. As previously indicated, there is a problem of non-ICT teachers’ lack of confidence and knowledge in ICT and the inability to transfer non-existent skills to students.

5.4: The Tangled Web of ICT Education

The results from the ten semi-structured interviews with ICT teachers revealed the six dominant categories of ICT Education, ICT Education Delivery, ICT Teachers, ICT Teacher Support, Teaching with ICTs, and Student Learning with ICTs (as described in Chapter 4). Further discussion of these categories occurred in this chapter with a particular emphasis on their enablers and inhibitors to assist in selecting the core categories, as well as differences between schools. Two minor categories emerged, School Differences and Non-school Issues. A summary of each follows:

- ICT Education: the flexibility of the compulsory learning years curriculum and the inflexibility of the VCE curriculum, the necessity of ICT curriculum and its successfulness, the variety of topics taught, the electives offered, students ICT Literacy levels, processes of integrating ICT, school terminology used, and a comparison of the Victorian system to some of those used overseas.

- ICT Education Delivery: looked into delivery methods, changes in delivery methods, loss of specialised ICT teaching, planning of delivering ICT content, and teachers’ personal preference for ICT delivery.
- ICT Teachers: their qualifications, responsibilities, teaching pathway, teaching style, first interest in ICT, enjoyment, and natural attraction, involvement in PD, self-improvement of skills, and extending student learning, and discussions of non-ICT teachers
- ICT Teacher Support: providing assistance, receiving assistance, school networks, and technical support
- Teaching with ICTs: brought out how teachers made a difference in engaging students, the advantages and problems of teaching with ICTs, preparing for classes, classroom resources used, ICT tool use, attraction to learning, and ICT tool access for students, network issues
- Student Learning with ICTs: student learning processes and learning styles, problems associated with student learning with ICTs, student ICT skills, ICT and student engagement, student interest in ICTs, attitudes to learning with ICTs, ICT tool use, problems associated with ICT tool use, and opportunities for ICT career association in the classroom, gender differences, senior IT offerings, senior curriculum, and senior student interest in IT study
- School Differences: differences in school size and type, ICT curriculum, ICT education delivery, ICT planning, ICT support, ICT classes, and equipment access
- Non-school Issues: impacts of social, family, financial, and the home.

It was apparent throughout this research that, though not unexpected, skilled ICT teachers were an integral part of ICT education and without them, appropriate ICT education may not occur. To represent ICT teachers views diagrammatically, development of a tentative substantive model depicts a labyrinth of categories and threads. The model, ‘The Tangled Web of ICT Education’ (Figure 5.1), shows ICT teachers centrally, surrounded by the remaining dominant categories in a Web. The model also encompasses minor categories, as well as those of government and school influences of policies and infrastructures and ICT tools used by students and teachers (see Section 2.3). These two additional minor categories were included as they form a vital part of ICT education. The model, based on phase 1 of the research does not explain any relationships and only includes about half of the number of Grounded Theory processes (Wiesche et al.)
2017).

Through Grounded Theory openly coded data becomes core categories through the selective coding processes where the core codes relate to each other (see Section 3.5). The threads of the Web indicate multiple connecting lines that represent overlapping and interconnecting relationships.

![Figure 5.1: Tentative substantive model of ‘The Tangled Web of ICT Education’](image)

**5.5: Delimiting the Research**

The qualitative information that came from the interviews was quite extensive and supports Bryman and Bell’s (2011) comment that qualitative research can generate large data amounts. Selective coding includes reorganising, revising, rearranging and refining open codes; theoretical coding includes the delimiting or restriction of information; and Grounded Theory theory development the selection of one or two core categories to focus upon (see Sections 3.5 & 3.8). Evans,
Gruba and Zobel (2011, p. 142) describes the selection process as deciding on ‘what is “in” and what is “out”’ through some sort of criteria. The criterion for this project was to focus on those areas that were inhibiting or restricting the successful teaching of ICT in schools (see Sections 1.3, 2.6 & 2.6.1).

In delimiting the data to select the areas for further investigation, firstly, exclusion of all of the ICT Education Enablers (see Section 5.1) happened. The enablers section discusses areas that have had positive influences on ICT education, and therefore do not fit the aim of the research, which was to highlight the current inhibiting issues that ICT teachers face. Next, the exclusion of the inhibitor Sections 5.2.1 (Curriculum Obstructions), 5.2.4 (Equipment (In) Applicability), 5.2.5 (Non-school Impacting Issues), and 5.3 (School Differences of ICT Education) occurred. They include comments related to schools and their operation, the curriculum and its delivery, staffing, subjects, timetabling, and ICT tool selection, provision, and use. Those responsible for the areas listed directly above fall onto the schools, their leadership, and their governing body. Some are the responsibility of external bodies apart from the school; the curriculum is one of these, large panels of governmental and educational representatives do curriculum development. History had indicated that curricula takes years to design and test and prepare for implementation, and then once implemented individual schools in Australia have the autonomy over its structure and use. While others areas excluded depend on a school’s location, type, size, and funding allocation. Lastly, schools, subject departments or individual teachers make the decision on computing equipment and its use. Additionally, students’ parental influence and home environment are outside the range of this research project’s ultimate aim.

The above exclusion process left two remaining sections, Section 5.2.2 (Teacher Hindrances) and Section 5.2.3 (Perceptions of Students Skills and Opinions) for further exploration. Students’ ICT Literacy levels, a reported lack of ICT skills, attention and engagement in class, and ICT tool use were a few of the issues discussed in Section 5.2.3. This research project has shown that students acquire much of their ICT skills at school, indicating that they were somewhat dependent on what and how their teachers taught them. Students miss learning ICT aspects if teachers were underprepared; that is if teachers lack ICT knowledge, ICT skills, and confidence with ICTs. This research and that of others (e.g. Hattie 2003;
OECD 2005; Schleicher 2012; Sterling 2012; Working Group 1987) have indicated that teachers have a large influence on students, teachers are an important link in student learning, and that teachers abilities, knowledge, and teaching practices affect student outcomes. Therefore, the focus narrows to the teacher hindrance section (see Section 5.2.2), with the exception of teacher responsibilities that was excluded due to school issues.

Most of the inhibitors teachers faced related to some sort of teaching and learning support. Participants said that most, if not all of internally attended PD were not very useful to them, and if they did happen to be leading the session, no new knowledge was obtained. They often found it difficult to access appropriate PD or obtain assistance. Participants provided constant assistance to non-ICT teachers indicating that non-ICT teachers ICT skills were not up-to-date and that this was restricting their ICT teaching. Any teacher teaching with ICT needs to continually improve and update their skills to keep up with the dynamic nature of ICT. Updating and learning new computer skills for in-service teachers was usually dependent on professional development. Undertaking computing PD contributes to teachers’ skills and knowledge, which also increases their skills and confidence; teachers are then able to pass the knowledge on to students, and therefore their student knowledge increases.

According to the perceptions of participants, ICT PD, non-ICT teachers’ skills and knowledge, and teacher confidence with ICTs are areas of concern. However, the question remains, does what the interviewees say about non-ICT teachers ICT skills hold true, and do other teachers have problems with accessing appropriate ICT PD? These areas become the basis for the next phase of Grounded Theory theory development, where the collection of more data assists in saturating the theoretical codes. When further explored they may determine the extent of generalisability of interviewee comments to other teachers.

**5.6: Summary of Chapter 5**

In the few years leading up to the interviews, it seemed that schools were in the middle of great change with ICTs and education. In 2013, curricula had recently changed, core ICT classes were diminishing, and student computer access was increasing. The integration of ICT and striving for 1:1 student computer access has driven all teachers to include ICT skills into teaching. Participants have
noticed the loss of core ICT classes and that some non-ICT teachers were struggling to cope with the change.

This chapter focused on discussing the information collected from ICT teachers through ICT Education enablers and ICT Education inhibitors accompanied by a discussion of school differences for ICT education. ‘The Tangled Web of ICT Education’ drew together the areas from the interviews into a model. The chapter concluded by describing the delimiting process and the selection of the core categories, teachers’ ICT skills and teachers’ ICT PD. The next chapter investigates these emerging issues through literature that leads into the second phase of data collection.
Chapter 6: Literature on Emerging Core Categories

Chapter 5 discussed the outcomes of the interviews and through Grounded Theory selective coding the two core categories of teachers’ ICT skills and teachers’ ICT PD emerged. The objective of this chapter is to investigate literature related to those core categories to identify potential sub-categories (Glaser & Strauss 1967). The literature findings will assist in the development of questions for an online survey for the second phase of data collection. The chapter starts out by discussing teachers ICT skills and continues with an investigation into professional development, including PD effectiveness, PD in educational policies, PD participation, and PD options. The chapter concludes with evaluating PD options.

6.1 Teachers and ICT Skills

A skill is to use acquired knowledge or an ability to perform a task. The Pocket Oxford Dictionary of Current English, 5th edition reprint (1970, p. 789) defines skill as a ‘practised ability’ or ‘expertness’. Achievement of improved student learning is possible through supplying those teaching them with essential skills and knowledge (Hargreaves & Fullan 1992). ‘Teachers themselves need to be knowledgeable, skilled in, and positive in their attitude towards these subjects [Science, Mathematics and Technology] as well as be highly skilled in the associated curriculum planning, development, implementation and review and evaluation’ (Working Group 1987, p. 5).

Quality teaching is the foundation of student learning experiences. A technologically functioning world demands that students prepare ‘for higher expectations of education, life and work’ (Schleicher 2012, p. 11). Equipping teachers with knowledge and skills improved their ability to teach, increased their competence and confidence, and their effectiveness in the classroom, particularly when using computing tools (Hargreaves & Fullan 1992; Pirie 1982). Within each school, there should be consistency with the ICT skills each teacher teaches, making sure that content taught was correct (Pirie 1982). Teachers’ computing skills and knowledge need to include sufficient understanding of the subject and its pedagogy to be able to confidently teach individual skills, content, concepts, elements of computing knowledge, and how to use the tools (Curriculum K-12
Directorate 2009; DEAG 2013; Pirie 1982). Additionally, the teachers should be comfortable using the tools and believe that the use of technology would enhance teaching and improve their students' outcomes (Curriculum K-12 Directorate 2009; Lee & Winzenried 2009). Teachers that have high confidence and possess competent knowledge and skills were more likely to use computing tools in everyday teaching than those of lesser confidence, and lower knowledge and skills (Education and Accountability 2006).

The skills that constitute a computing skillset ‘are still not well defined’ (Johnson et al. 2011, p. 4), a teacher’s standard of teaching is limited to the extent of his/her knowledge and skills, and often these limit ICT opportunities in the classroom (Australian Government 2014). The dynamic nature of computing constantly challenges ICT education, making it difficult for teachers to keep up and learn newer skills (Bastian 2014). Generally, computing changes faster than curriculum development (Johnson et al. 2011). These issues contributed to teachers ‘lagging behind’ in the knowledge of ICT skills and with their use of the skills in the classroom (Jordan 2011, p. 427). Sterling (2012) reported that schools and teachers’ attention to computation skills have slowly degraded through the last few decades. Schleicher (2012) and Sterling (2012) have called for increased opportunities for teachers to gain stronger technological skills, to teach concepts that were more complex, and to use computing tools effectively in their teaching. However, teacher use of computers in education is prominent. Most teachers have used computers in their classes at least once a week (De Bortoli 2014) for the last five years (De Bortoli 2014; Meredyth et al. 1999). The challenge for teachers is to develop new ideas from their experiences and continually improve and update their knowledge through practice. Teachers need to understand how students learn within and outside of school through what they do and what they use, including technology (Schleicher 2012). However, it is important to remember that it is not the technology that improves student learning; rather it is the teacher, the learning experiences offered, and the type of technology used and how it is used (DEAG 2013; Lee & Winzenried 2009).

6.2: Investigating Professional Development

Acquiring a skill usually requires training, reading, or research of some sort. Engaging in PD re-engages teachers, improves their skills and knowledge through
up-skilling or re-skilling, addresses specific needs, provides opportunities to share knowledge, practice with colleagues, and connect with the broader educational community through professional learning activities (Finger et al. 2007; Goldman 2003; Review and Evaluation Directorate 1991; Victorian Institute of Teaching [VIT] 2012b).

Professional development is also known as professional learning, teacher development, staff development, in-service training, and professional support. Professional development activities are varied and have different purposes; they could focus on policy, curricula, or educational system changes, school development, teaching needs, introduce new teaching materials and skills, classroom practice, or to keep abreast of new knowledge (Centre for Educational Research and Innovation [CERI] 1998; Hughes 1991; VIT 2012b). Ultimately, the aim of attending PD is for teachers to implement the skills gained, make changes to their teaching practice, and to improve student outcomes (Australian Institute for Teaching and School Leadership [AITSL] 2011; Cole 2004; Ferrier 1995; Review and Evaluation Directorate 1991).

6.2.1: Professional Development Effectiveness

A constant challenge of the role of education is to prepare students for the future based on current and past information and resources and to keep up to date with educational and social expectations. Critically, teachers need to be equipped with the knowledge, skills, and expertise to deliver information to students to develop their capabilities in an appropriate and timely manner (DET 2005; Finger et al. 2007). For this to occur, sufficient and appropriate PD needs to be available (Finger et al. 2007).

Effective PD transforms teaching through sessions that are future focused, relevant, collaborative, reflective and supportive (AITSL 2011; Hughes 1991; OECD 2005; Lee & Winzenried 2009). These effective sessions are entrenched in practice, informed by research, and are evidence based, with the sessions providing opportunities to learn knowledge and content through active learning (DET 2005; Ingvarson, Meiers, & Beavis 2005; Maiolo 2014). They aim to improve teaching practices, encourage teacher development, encompass applicability to student learning, provide student learning examples, develop
wider understandings, directly address the context, allow time for practice, include teacher reflection, provide follow-up support and collect session feedback (Albert et al. 2014; DET 2005; Ingvarson, Meiers, & Beavis 2005; Lloyd & Cochrane 2006; Maiolo 2014; Schleicher 2012).

Research has shown that effective PD has had positive effects on teachers. For example, a year-long PD program in Mathematics improved both teachers’ and students’ knowledge (Pape et al. 2015), and professional development held near to teachers’ home environments increased their attendance and content satisfaction (Avalos 2011). Most important of all, effective PD needs to be ongoing, timely, sequential, and regular (ACCE 2015; DET 2005; Lee & Winzenried 2009; Lloyd & Cochrane 2006; Schleicher 2012). One avenue to ensure ongoing PD is to develop professional learning teams and make them part of a school’s normal routine, teachers can mentor each other, discuss, share, and coordinate their teaching (Callaghan 2014; DET 2005).

Teachers who attend effective PD sessions need to be active attendees to achieve the best outcomes, they should aim to bring change to their instructional practices, the content taught, their attitudes and beliefs, and consider their PD in view of their teaching standards (Hughes 1991; OECD 2005). Additionally, the flow-on effect increases the effectiveness and spread of PD. A recommendation from DET (2005) and Schleicher (2012) was for when teachers had attended an external PD session, they were encouraged to bring the information back to their school and share it (as mentioned in Section 4.2.3.3 by some interviewees). Similarly, an ICT outreach activity created such enthusiasm among its attendees that some began conducting their own workshops within and outside of their own schools and therefore reached more people who could spread the information further (Lang & Thurairasa 2013). However, not all instances of sharing details from external PD after return to school were valid; situations may arise where the attendee is just not confident enough with the new knowledge to share it soon after learning it (Review and Evaluation Directorate 1991).

6.2.1.1 Professional Development Downfalls

Not all PD is worthwhile; the perception of professional development effectiveness can even differ between attendees. Typical problems with PD
include not addressing specific teaching concerns and the timing of sessions. The Centre for Educational Research and Innovation (1998) and Cole (2004) have noted that often what was termed as PD did little to improve teaching quality or student learning, was a waste of money, took up teachers’ valuable time, was rarely developmental, lacked focus, or was fleeting and fragmented. Not all professional development sessions created positive changes in teaching practices, with some teachers reverting to their older practices (Avalos 2011).

What is meant by PD has been misunderstood, professional development opportunities have been under-utilised in schools, and the links between teachers’ PD, teacher education, and school needs were somewhat limited (Cole 2004; OECD 2005; Schleicher 2012). Ineffective PD programs rarely built feedback or classroom coaching into their sessions and had infrequent or non-existent follow-up support and evaluation, these contributed to their general failure and an unknown impact on students in the classroom (Fullan 1982; Ingvarson, Meiers, & Beavis 2005). Furthermore, there seems to be a lack of support for teachers and PD (Schleicher 2012). The lack of support includes problems accessing technical support, equipment, and appropriate training (Education and Accountability 2006; British Educational Communications and Technology Agency [BECTA] 2003; Jones A 2004).

Complaints occurred about one-off workshops; Fullan (1982) described them as ineffective, and DET (2005) as not enhancing teachers’ learning. Hughes (1991) explained that a one-off occurrence was not sufficient and that PD should occur throughout a teacher’s career. In addition, Aston (1988, p. 81), suggest that the duration of some PD sessions as ‘too short to deal with issues in sufficient depth’ for effective learning to take place.

Often, school decision-makers select professional development topics and determine teachers’ needs; these sessions mostly do not address the individual needs or concerns of the teacher (Fullan 1982; Timperley 2011). Other PD downfalls include PDs not developing teachers’ skills and knowledge sufficiently, not meeting school needs, and not improving teacher self-confidence, attitudes, or perceptions of teaching and learning (BECTA 2003; Jones A 2004; OECD 2005).
6.2.1.2: Professional Development and Computing

For effective computer use, Finger et al. (2007) described two conditions. First, educators need the proficiency to use digital skills and knowledge to plan, process, design, deliver, assess and support their teaching and student learning, and second, they need effective teaching and learning practices to translate their proficiency of ICT into the learning environment (Finger et al. 2007).

Professional development has been termed as ‘a key factor to successful integration of computers into classroom teaching’ (Buabeng-Andoh 2012, p. 147). When there was a lack of training available or it was not undertaken, teachers were less likely to integrate computers into teaching (Hechter & Vermette 2013; Jones A 2004).

When planning for computer PD, the aims are to increase teachers’ skill level, computer competence and confidence, and to meet the school’s curriculum computing requirements (Curriculum K-12 Directorate 2009; Fraillon 2014; Woodhouse & Jones 1988). Additional factors that need consideration are what teachers need to know, what students need to learn, availability of resources, class release time, and time for teachers to learn and consolidate new skills (Curriculum K-12 Directorate 2009; Fraillon 2014; Woodhouse & Jones 1988).

In the early years of computing in schools, teachers reported that externally run courses filled up quickly and their organisers had to select particular teachers to attend (Grundy et al. 1987).

Teachers have indicated a need for computing PD to improve their skills (De Bortoli 2014; Meredyth et al. 1999; OECD 2015; Schleicher 2012). In addition, multiple stakeholders have requested a greater focus on ICT teacher and student capacity at schools (Australian Workforce and Productivity Agency [AWPA] 2013a). To build the capacity of ICT in teachers, teachers need to have access to and be encouraged to undertake ongoing and relevant computing professional development (AWPA 2013b; Goldman 2003). The importance of computing PD for all teachers needs urgent attention, for not only skill and knowledge improvement, classroom use, and capacity building, but for the essentiality of teaching Digital Technology capabilities in the Australian Curriculum (ACCE 2015; Australian Government 2014; AWPA 2013b; Bastian 2014).
Teachers can be underprepared to deliver the ICT curriculum because of a lack of exposure to ICT training, a lack of ICT skills and knowledge, or a lack of confidence (Bastian 2014; De Bortoli 2014; Goldman 2003; OECD 2015; Phillips 2015; Woodhouse & Jones 1988). A lack of teachers’ skills and knowledge affects those obtained by students (Australian Government 2014; AWPA 2013b; Phillips 2015). Callaghan (2014) remarked that particularly in the computing field, keeping teachers’ skills up-to-date was difficult because their extent of knowledge can vary enormously. Unconfident or not well-trained teachers may revert to teaching out of a book or teach less content than what was required (Bastian 2014). The challenge exists for teachers to strengthen their ‘technical core’ of teaching practices (Schleicher 2012, p. 45).

Research indicates that increased computing PD effectively improved teachers’ skills and computing content knowledge, increased computer use and integration into teaching and learning, advanced computing capabilities, and built teacher’s confidence (ACCE 2015; Australian Government 2014; Education and Accountability 2006).

**6.2.2: Professional Development and Educational Policy**

Educational policies have included directions for teachers to use computers in teaching since 1985 when Commonwealth and State governments made the decision for computer use in education (see Section 2.1.2) (State Board of Education 1985). They included provision for computing PD for ‘as many teachers as possible’ in Victoria (State Board of Education 1985, p. 10). The following year, 1986, the Commonwealth abandoned its ‘Schools Commission Professional Development Programme’, moving away from an inflexible and rigid system with a national focus on PD to an individualised focus to give teachers and their schools the responsibility and flexibility to provide appropriate PD (Hughes 1991; Standards Council of the Teaching Profession Victoria [SCTPV] 1996).

Changing the responsibility for PD, however, did not improve it. By 1994, recommendations once again included computer PD and training for all school staff (Report of the Victorian Government Working Party on the Use of Technology as an Education and Communications Facility in Schools [VGWPTE] 1994). Problems identified by regional computer consultants (see Section 2.1.3.1)
were teachers’ lack of computer confidence, keeping up with technology changes, teachers’ views on student learning with technology, access to computers, teachers’ poor attitude to ICT subjects, and the mystery and fear of technology (VGWPTE 1994). Subsequently, Victorian schools were required to assist teachers in developing an individual PD plan that linked their needs and longer term objectives with that of the school’s charter and the school’s PD goals (SCTPV 1996).

Schleicher (2012), and the OECD (2005) defined that educational authorities and policy developers needed to consider how to encourage teacher participation in PD, how to support teachers to meet their learning needs, how to sustain teachers’ teaching quality, and how to engage all teachers into ongoing effective professional development. Blackmore et al. (2003) argue that policies for PD in ICT have failed to improve outcomes for disadvantaged school students; policies do not deal effectively with student differences, learning styles, cultural aspects, equity, anxiety levels, or individuality, and they challenge the teacher’s professionalism.

6.2.2.1: Victorian Teachers Professional Development Requirements

Teachers undergoing registration renewal in Victoria from 2008 had to declare they undertook and recorded PD activities that met a designated amount and variety (VIT 2012a). From 2012, teachers entered a five-year registration term where they were required to undertake a minimum of 100 hours of PD during their registration term (VIT 2012a). The PD activities they recorded need to include:

- the activity’s applicability and reference to teaching standards
- meeting at least one teaching standard in each of the three domains of Professional Practice, Professional Engagement and Professional Knowledge
- the date and duration
- the activity type
- its effectiveness
- how the activity enhanced their professional knowledge or practice (VIT 2012a).
There was no specific requirement for the PD to be ICT related.

Half of the PD activities had to originate externally from their school and include knowledge and research, while, the remaining had to include knowledge, research, and activities that enhanced their teaching practice or their personal well-being (VIT 2012a). The presentation could be by an external presenter or a colleague, or through collaboration with other teachers, and these could be school arranged or undertaken at the initiative of the individual (VIT 2012b).

Currently registered teachers are transitioning between the five-year registration requirements and newer one-year registration requirements. The one-year teacher registration term mandates a minimum of 20 hours PD (VIT 2015). Requirements are similar to those of 2012 with the addition of descriptions of activities, undertaking at least one PD activity relating to students with special learning needs, certification and/or verification of attendance, payment receipts, and personal reflections on activities attended (VIT 2015). There is no set requirement list for PD activities and those chosen should reflect the individual teacher’s professional learning needs, student needs and school needs (VIT 2015). Sessions can be taken in groups with other colleagues or individually, and can include online options (see Figure 6.1 for examples of activities) (VIT 2015).

No specific requirements exist for computing PD activities. However, under the Professional Knowledge domain, a requirement for teachers is that, ‘They are also able to use Information and Communication Technology to contextualise and expand their students’ modes and breadth of learning’ (AITSL 2011, p. 4).
The Victorian Government school system allocates seven student-free days per year. Four of these days are set aside for a combination of school planning, administration, curriculum development, professional development, student assessment and reporting, with each school determining the focus of the remaining three days (DET 2016c). Additionally, teachers are able to apply for study leave to attend informal or formal courses; however, applications and proposed study must meet certain criteria and be approved by the applicants’ school principal (DET 2016b).

Gul (2014) argues that school PD should be held outside of regular school term days and not as part of them. Gul (2014) said that the mandated PD hours and student-free days should not take the focus away from student learning, and teacher access to these activities should occur outside of the school term times such as during school term breaks and on public holidays. His reasoning for this was that ‘Teachers exist for the student’s benefits, and we can be of greatest benefit to them by not asking them to stay at home while we learn about our
school’s raft of new policies or how to use new classroom technology’ (Gul 2014, p. 54).

### 6.2.3: Professional Development Participation

This professional development participation section draws its details from four reports:

- an Australian national sample of IT skills in schools (Meredyth et al. 1999)
- Australian data from the 2013 International Computer and Information Literacy Study (ICILS 2013) (De Bortoli et al. 2014)

Consistent numbers of Australian teachers participated in PD according to TALIS 2008 and TALIS 2013; both reported that 97% of participants attended at least one PD session in the previous 12 to 18 months (OECD 2016; Schleicher 2012). The 2008 participants attended PD on average for 9 days per year; almost half of those occurred on compulsory PD days (Schleicher 2012). They participated in PD through informal dialogue (94%), courses and workshops (91%), reading professional literature (82%), educational conferences and seminars (64%), through a PD network (60%), mentoring and peer observation (49%), individual and collaborative research (37%), observation visits to other schools (22%), and qualification programs (12%) (Schleicher 2012). About half of the TALIS 2013 participants attended PD sessions spread over an extended time, and around 38% participated in individual or collaborative research (OECD 2016).

Many of the teachers who partook in the national sample (91%) said that computing PD was available to them; however, only three quarters had attended at least one session in the previous two years, and less than two-thirds had attended for 10 hours or less (Meredyth et al. 1999). Half of those who attended agreed that the computing PD was at a suitable and accessible location, and contained sufficient information, with almost half agreed that the sessions were available through schools, and delivered satisfactorily (Meredyth et al. 1999). However,
only a third said they were suitably scheduled (Meredyth et al. 1999).

The ICILS 2013 report indicated that most Victorian students (83%) attended schools where teachers had participated in professional development on using computing in teaching in the past two years (De Bortoli 2014).

6.2.3.1: Professional Development Support Received

Support for teachers attending professional development has generally increased over the years. Meredyth et al. (1999) reported that two-thirds of Australian teachers received no support for computing PD. However, most TALIS 2008 teachers indicated that they received scheduled time away from teaching (86%), three-quarters did not pay anything, and almost a quarter contributed to the cost (Schleicher 2012). Only a few teachers received a salary supplement (6%) to attend PD (Schleicher 2012). By TALIS 2013, fewer teachers received time release (79%), about three-quarters received financial support, half a PD development plan, one-fifth non-monetary support, and 4% received a salary supplement (OECD 2016). These reports show that most Australian teachers received the support of some kind to attend PD. An interesting finding reported by Schleicher (2012) was that internationally, teachers who paid for all of their PD expenses tended to participate in twice as many programs as those who did not pay at all.

6.2.3.2: Non-Participation in Professional Development

Teachers cited various reasons why they did not take further PD in the TALIS 2008 survey than they had undertaken. The most common responses were conflicts with work schedule (62%) and no suitable PD available (41%) (Schleicher 2012). Less common responses were that the PD was too expensive (33%), family responsibilities (28%), lack of employer support (27%), and a small minority (3%) did not have the required pre-requisites (Schleicher 2012).

Nearly all of the national sample participants wanted further computing PD (Meredyth et al. 1999), and over half of the TALIS 2008 participants were unsatisfied with the amount and type of professional development they had attended and wanted more PD than they had received in the previous 18 months, particularly in computing (Schleicher 2012). Teachers who were new to the profession reported a greater need for PD than they had received, and had
attended fewer sessions than teachers who were more experienced (OECD 2012). Participants in three of the above data sources indicated that professional development had not met their needs. Meredyth et al. (1999, p. 177) reported that ‘most teachers did not agree that the availability of [computer] training is adequate to meet their needs as teachers’ and that almost half of the participants said that they were not sufficiently informed about incorporating computers into the curriculum. More Australian teachers who responded to the TALIS 2008 survey indicated a need for ICT teaching skills (18%) than for skills to teach students with special learning needs (15%) (Schleicher 2012). However, a requirement for professional development for students with special needs has been included in the Victorian teacher renewal requirements while computing skills have not (see Section 6.2.2.1) (VIT 2015). Less than ten percent of Australian teachers indicated that they required PD for content and performance standards, student assessment practices, classroom management, their subject field(s), and instructional practices (Schleicher 2012). In the more recent report for ICILS 2013, 41% of Victorian Year 8 teachers said they did not have sufficient provision to develop their ICT expertise (De Bortoli et al. 2014).

6.2.4: Professional Development Options

6.2.4.1: Professional Development Delivery Methods

The delivery of PD can be via a number of avenues, informal, formal, face-to-face, and online. Informal methods could include one-to-one with another school employee or person from outside of the school, an informal group teacher meeting with shared discussion, an informal professional learning team, a mentor coaching session, or independent research or readings (DET 2005; Grundy et al. 1987; Review and Evaluation Directorate 1991; SCTPV 1996). Often an informal session begins on a ‘need to know’ basis (Grundy et al. 1987, p. 45).

Formal PD delivery includes courses where the attendee receives a certificate on completion and attainment of certain work modules. Tertiary institutions and other educational providers offer formal accredited courses by remote access, attendance, or through distance learning training packs (AITSL 2014; Aston 1988; CERI 1998; Hughes 1991; Review and Evaluation Directorate 1991). Formal courses may be at an introductory level or an advanced level, such as a Post-
Graduate Certificate; often they focus on a specific field and involve costs (CERI 1998; De Bortoli 2014; Grundy et al. 1987; SCTPV 1996).

Face-to-face delivery methods of PD involve at least two people in a group setting where one presents information to the others in the same room. Delivery can be in many forms, such as school-based in-service, consultations with experts, conferences, workshops, seminars, demonstrations, short courses, through a learning network, or collaborated with other educational providers (AITSL 2014; Blackmore et al. 2003; CERI 1998; DET 2005; Meredyth et al. 1999; Review and Evaluation Directorate 1991). Teachers sometimes favoured workshops as they usually contain both practical and theoretical applications and assist in deepening teachers understanding of the subject matter (DET 2005; Review and Evaluation Directorate 1991).

Online delivery methods involve the use of a computer that is Internet connected; this form of delivery is growing in popularity (Bates, Phelan & Moran 2016). There are multiple avenues for online PD, with newer methods developed regularly (AITSL 2014). These include video-conferencing, short courses, tertiary courses, collaborative workspaces, webinars, mediated forums, discussion groups, and use of digital resources (Blackmore et al. 2003; De Bortoli 2014; Meredyth et al. 1999). Mostly, online sources include self-directed learning by remote access making them ideal for downloading for later use, for teachers to do at home, for those in distant locations, for when the schools’ Internet restricts access, and for when the time was limited to short instances (AITSL 2014; Blackmore et al. 2003). Albert et al. (2014) describe video-conferencing as an acceptable method of PD delivery where distance was an issue, it provided similar support to face-to-face methods and reduced travelling time, however, the person presenting needed to be knowledgeable in both pedagogical and technical matters. Bates, Phelan and Moran (2016) described the choice of online methods as up to the teacher to consider based on his/her learning style, expertise level, ultimate goals, and convenience and cost. Although, relying on online methods could create isolated learning, extending the learning to include discussions with colleagues could overcome this problem (Bates, Phelan & Moran 2016; Blackmore et al. 2003).
6.2.4.2: Other Professional Development Considerations

Several other considerations surround professional development includes the session content, how far the teacher is willing to travel, how much they would be willing to pay, the time of day the session occurs, how often a teacher wishes to attend, and how long each session goes for. Section 6.2 described some content types of PD. Kim, Jung and Lee (2008) found that the perceptions of experts and teachers differed when it came to ICT Literacy content.

The distance teachers would be willing to travel for PD depends on their own location, their school’s location, and accessibility to the PD location (Blackmore et al. 2003). According to the Review and Evaluation Directorate (1991), a moderate travelling distance would be 30 kilometres or a half-hour. The financial outlay for PD depends on the school’s economic status, the teachers earning income, their family situation, their distance from the PD location, and length of stay (Blackmore et al. 2003; Review and Evaluation Directorate 1991). Non-financial costs include gaining leave from school and time for travel and attendance (Review and Evaluation Directorate 1991). Australian teachers have the possibility of claiming some work-related costs paid out of pocket as taxation deductions.

In the past, teachers have preferred attending PD on school days, on student free days, or soon after school has ended (Meredyth et al. 1999; Review and Evaluation Directorate 1991). Research showed that very few teachers preferred PD on weekends, during school holidays, or in the evening, as these times would affect a teacher’s family commitments (Meredyth et al. 1999; Review and Evaluation Directorate 1991). The Curriculum K-12 Directorate (2009) listed ongoing PD as very effective; however, this was not always possible for all schools to supply. Professional development could run from short sessions of 15 minutes, medium sessions of up to two hours, or for a longer session of a day or more (Aston 1988; Callaghan 2014; SCTPV 1996). Avalos (2011) determined that extended sessions were more effective than shorter sessions, although time was limited for teachers to attend longer sessions.

6.2.4.3: Evaluating Professional Development Options

When deciding upon whether to undertake computing PD, Lawless and Pellegrino
(2007) proposes that examining the technical support, the session(s) duration, type, content, frequency, and follow-up procedures. They also suggest that after the session evaluation of the presenter’s attitude, knowledge and instructional methods could occur, along with the students’ long-term outcomes (Lawless & Pellegrino 2007). Timperley (2001) also advocates using student outcomes as an evaluation method to determine future teacher PD needs. Assessed and observed student outcomes can highlight areas of deficiencies and effectiveness that could indicate where change was needed (Review and Evaluation Directorate 1991; Timperley 2011).

Fishman et al. (2013) and Cole and Styron (2006) compared online PD and face-to-face PD methods and found no statistical difference in teachers’ preferences; teachers can learn equally well with either method. Cole and Styron (2006) also indicated that an online method was slightly preferred over the face-to-face method; if participants were to undertake further PD they would select an online method. However, Meredyth et al. (1999) determined that face-to-face PD was more popular than distant learning, whereas, Blackmore et al. (2003) indicated that teachers preferred both face-to-face methods and printed PD material.

Worldwide research showed that differences were evident with what professional development methods suited teaching practices and those that were better for student outcomes. Collaborative research, qualified programs and informal discussions were preferred for greater teaching practice impact over one-offs, seminars and conferences (AITSL 2012). While the practice of newer approaches, observations and feedback had a greater impact on school student outcomes than attending lectures, visiting other schools and discussions (AITSL 2012).

Deciding on what PD activity to select requires some thought. Aston (1988) and Mueller et al. (2008) suggest that no one single method guarantees more success over any other in all situations. Individual teachers’ needs differ and evaluation of the same PD will vary between attendees (ACCE 2015). The most successful professional development includes elements of sharing ideas and school-based tasks (Aston 1988). As with online methods (see Section 6.2.4.1), relying on only one form of PD would not benefit teachers; optimal learning requires variety (Cole & Styron 2006; Hughes 1991). A mixture of informal, formal, face-to-face and online methods of PD would benefit teachers the most to improve their
abilities (Hughes 1991; Maiolo 2014).

Different authors have their own opinion on the arrangement of professional development. Callaghan (2014) prefers a whole-school approach, Owusu (2014), a group focus, with teachers from the same or nearby schools, and Cole (2004), the Curriculum K-12 Directorate (2009), and Timperley (2001) an individual focus. Cole (2004), Curriculum K-12 Directorate (2009), and Timperley (2011, p. 31) say an individual focus can better meet individual teacher’s needs and teaching circumstances and give them ‘responsibility for their own learning’.

**6.3: Summary of Chapter 6**

The aim of the chapter was to investigate literature related to the core categories of teachers’ ICT skills and teachers’ ICT PD to enable the development of survey questions. The chapter generally discussed teacher’s ICT skills and a range of areas relating to professional development including its effectiveness, Victorian teachers’ requirements, past participation, and available options. The following chapter presents the questionnaire results.


Chapter 7: Survey Results

The results of the interviews and their discussion highlighted the core categories of teachers ICT skills and teachers’ ICT professional development. The literature investigation of these areas discussed in Chapter 6 assisted in forming the questions for an online survey. The purpose of this chapter is to present the results of that questionnaire through univariate analysis. Firstly, descriptions of the respondents and their schools are given, and then the responses to computing skills questions provided. Following these are the experiences that respondents have had in past computing PD. Lastly are respondents’ replies to what type of computing PD they would like in the future. A reminder for the reader is that the interviews had participants and the survey, respondents (see Section 3.6).

7.1: Survey Respondents

The survey (Appendix E.2) collected demographic details about the respondents and their schools. Of the 36 usable responses from Victorian teachers, 28 were from government schools, five from independent (non-Catholic) schools, one from a Catholic school, and two who did not indicate. The majority of the respondents taught in secondary schools (Table 7.1). All of the respondents had taught more than a single year level in their respective schools.

The respondents varied considerably in age and teaching years. Three times as many females (24) responded than males. One-third of the respondents were thirty years old or less and approximately one-fifth in each of the other age groups (Table 7.1). About half of the respondents had less than six years teaching experience, and four respondents did not fully complete the questionnaire (Table 7.1).
<table>
<thead>
<tr>
<th>School Type</th>
<th>n</th>
<th>%</th>
<th>Age Range</th>
<th>n</th>
<th>%</th>
<th>Teaching Years</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary (P-6)</td>
<td>4</td>
<td>11%</td>
<td>&lt; 31</td>
<td>12</td>
<td>33%</td>
<td>&lt; 6</td>
<td>16</td>
<td>44%</td>
</tr>
<tr>
<td>Secondary (7-12)</td>
<td>24</td>
<td>67%</td>
<td>31 - 40</td>
<td>6</td>
<td>17%</td>
<td>6 - 10</td>
<td>5</td>
<td>14%</td>
</tr>
<tr>
<td>Combined (P-12)</td>
<td>5</td>
<td>14%</td>
<td>41 - 50</td>
<td>7</td>
<td>19.5%</td>
<td>11 - 15</td>
<td>6</td>
<td>17%</td>
</tr>
<tr>
<td>Special Needs Education</td>
<td>1</td>
<td>2.5%</td>
<td>&gt; 50</td>
<td>7</td>
<td>19.5%</td>
<td>16 - 20</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>Unknown</td>
<td>2</td>
<td>5.5%</td>
<td>&gt; 20</td>
<td>5</td>
<td>14%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>36</td>
<td>100%</td>
<td></td>
<td>36</td>
<td>100%</td>
<td></td>
<td>36</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 7.1: Demographic information of respondents and their workplace

Respondents were asked if they taught in a specialist subject area or not, and to list their specialist areas. Four of the respondents did not teach in a specialist curriculum area and were primary teachers. The remaining respondents indicated that together they were specialised in one or more subject areas consisting of; Science, Mathematics, English, Languages other than English, Health, Physical Education, Art, History, Humanities, Music, Drama, Commerce, Technology, ICT, Web Design, Media, Multimedia, and VCE subjects of Mathematics, Mathematical Methods, Biology, Business Studies, Systems Engineering, Physics, Psychology, and IT.

A question was included for respondents to indicate when they first encountered computers. Three began using computers prior to starting school, nine during primary school, seven during secondary school, three in undergraduate studies, two in Post-Graduate studies, six in the workplace, and two at home; one of these was in his/her primary years and the other did not indicate what age they were. Seven of the respondents had formal qualifications in computing education.

### 7.2: Computing Skills

The second section of the questionnaire asked questions about respondents computing skills, using ICT tools, teaching computing concepts, opinions of core computing classes, and on whether their ICT skill level affected their teaching of computing. Survey respondents reflected on and rated their own computing skills. Respondents selected either intermediate (42%), advanced (50%), or superior (8%); with none indicating that they were a novice or had non-existent computing skills.
skills.

7.2.1: ICT Tool Use

The first question, in this section, asked for an indication of how often respondents used computer tools in their teaching. Most used ICT tools such as Smartboards, Tablets, Desktop Computers, Laptops, Netbooks, and Data projectors regularly in their teaching (72%), some used them at least weekly, a few less often, and one never used computer tools while teaching (Table 7.2).

<table>
<thead>
<tr>
<th>Frequency of Respondent Use</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td>Less than once a week</td>
<td>2</td>
<td>5.5%</td>
</tr>
<tr>
<td>Once a week</td>
<td>2</td>
<td>5.5%</td>
</tr>
<tr>
<td>Multiple times a week</td>
<td>5</td>
<td>14%</td>
</tr>
<tr>
<td>Once a day</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>Multiple times a day</td>
<td>26</td>
<td>72%</td>
</tr>
</tbody>
</table>

Table 7.2: Respondents frequency of use of computing tools in their teaching

Additionally, respondents commented on how long students at their school had used computers in the classroom. Examples of student activities provided were students creating Blogs and Podcasts, using the Internet or word processing software. Respondents indicated that almost all students had been using computers in their school’s classrooms for at least one year (Table 7.3).

<table>
<thead>
<tr>
<th>Years of Student Use</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 1 year</td>
<td>3</td>
<td>8%</td>
</tr>
<tr>
<td>1 to 3 years</td>
<td>15</td>
<td>42%</td>
</tr>
<tr>
<td>4 to 6 years</td>
<td>8</td>
<td>22%</td>
</tr>
<tr>
<td>7 to 9 years</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td>10 to 12 years</td>
<td>3</td>
<td>8%</td>
</tr>
<tr>
<td>More than 12 years</td>
<td>6</td>
<td>17%</td>
</tr>
</tbody>
</table>

Table 7.3: Length of time students have used computer in the classroom
7.2.2: Teaching Computer Concepts

Three questions about the teaching of computer concepts were included in the questionnaire. The first related to how often respondents had taught computer concepts in classes regardless of their specialised curriculum teaching area. Computer concept examples given were file management, data storage or word processing. Table 7.4 shows a four-way split with 28% indicating never or rarely, 25% sometimes, 28% quite often, and 19% all of the time.

<table>
<thead>
<tr>
<th>Regularity</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>4</td>
<td>11%</td>
</tr>
<tr>
<td>Rarely</td>
<td>6</td>
<td>17%</td>
</tr>
<tr>
<td>Sometimes</td>
<td>9</td>
<td>25%</td>
</tr>
<tr>
<td>Quite Often</td>
<td>10</td>
<td>28%</td>
</tr>
<tr>
<td>All of the time</td>
<td>7</td>
<td>19%</td>
</tr>
</tbody>
</table>

Table 7.4: How often respondents taught computer concepts in class

The second question asked whether respondents considered their level of computer skills sufficient to teach computing education concepts. Sixty-six percent indicated most of the time or always, with the remaining percentage often, sometimes or rarely (Table 7.5).

<table>
<thead>
<tr>
<th>Regularity</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rarely</td>
<td>4</td>
<td>11%</td>
</tr>
<tr>
<td>Sometimes</td>
<td>6</td>
<td>17%</td>
</tr>
<tr>
<td>Often</td>
<td>2</td>
<td>5.5%</td>
</tr>
<tr>
<td>Most of the time</td>
<td>17</td>
<td>47%</td>
</tr>
<tr>
<td>Always</td>
<td>7</td>
<td>19%</td>
</tr>
</tbody>
</table>

Table 7.5: Respondents opinions of skill level sufficiency to teach ICT concepts

\[3 \text{ Rounding of percentages to the nearest half of a percent resulted in a few tallies not equating to 100%}.\]
Respondents were requested to indicate how prepared they thought they were to teach computer concepts for the impending implementation of Digital Technologies in the national curriculum. Around 28% indicated that they thought they were not prepared or underprepared, 42% were moderately prepared, and around 30% thought they were well prepared or very well prepared (Table 7.6).

<table>
<thead>
<tr>
<th>Preparedness Level</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not prepared</td>
<td>2</td>
<td>5.5%</td>
</tr>
<tr>
<td>Underprepared</td>
<td>8</td>
<td>22%</td>
</tr>
<tr>
<td>Moderately prepared</td>
<td>15</td>
<td>42%</td>
</tr>
<tr>
<td>Well prepared</td>
<td>9</td>
<td>25%</td>
</tr>
<tr>
<td>Very well prepared</td>
<td>2</td>
<td>5.5%</td>
</tr>
</tbody>
</table>

Table 7.6: Respondent preparedness for the national curriculum

7.2.3: Opinions of Core Computing Classes

Respondents were asked to select all the statements they agreed with from six provided about core computing classes. They were able to choose more than one response. The three least chosen options were core-computing classes were not necessary, core-computing classes should only teach the fundamentals of computing and that these classes were not necessary as they were integrated (Table 7.7). The table also indicates a moderate agreement to core computing classes teaching all computing concepts and ICT Literacy, a high agreement that they are essential to teach computing concepts and an even higher agreement that they are essential to make sure all students are ICT literate.
7.2.4: Respondents ICT Skill Level Effect on Teaching Computing

The respondents replied to a question on whether they thought that their skill level affected the way they taught computing education. Seven replied that their skill level did not influence their computing teaching ability; however, twenty-nine noted that it did. Respondents were able to provide a written response to explain their choice.

There were respondents without formal computer qualifications who were sufficiently computer confident to be able to assist students with computing education. They wrote that they could assist with problem-solving, introduce new concepts and provide detailed descriptions, answer questions, offer assistance, ensure students understood ICT concepts and were confident with sharing and uploading files. One of these respondents summed up the comments with ‘Understanding the concepts and procedures to complete various tasks on the computer allows me to convey this information to my students and the most efficient and simplest way to do it’. Three computer confident respondents with formal computing qualifications additionally commented that a higher skill level, experience, confidence, and extra knowledge counted when teaching students computer education, ‘I am more confident to try new things,’ and, ‘I teach concepts others don’t because I have a better understanding’.

Significantly, over a third of the respondents made comments recognising that their ICT skill level was a barrier to the way they taught ICT education. Comments related to limiting teaching to familiar concepts, mostly due to restricted time. ‘I seem to teach concepts that I am most familiar with and not

<table>
<thead>
<tr>
<th>A core computing class:</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Should teach all computing concepts and ICT Literacy</td>
<td>13</td>
<td>21%</td>
</tr>
<tr>
<td>Is essential to teach computing concepts</td>
<td>17</td>
<td>28%</td>
</tr>
<tr>
<td>Is essential to make sure all our students are ICT literate</td>
<td>23</td>
<td>38%</td>
</tr>
<tr>
<td>Should only teach the fundamentals of using computers</td>
<td>2</td>
<td>3%</td>
</tr>
<tr>
<td>Is not necessary because computing is integrated into other subjects</td>
<td>6</td>
<td>10%</td>
</tr>
<tr>
<td>Is not necessary</td>
<td>0</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 7.7: Opinions of core computing classes
explore new things often due to time constraints,’ and, ‘I tend to keep to programs that I know well and rarely have time to use a program in which I don’t feel confident’. Some respondents spoke of only teaching the basics; ‘At this stage, all I teach students is the basics (word processing, Internet searches, emails),’ and, ‘I lack the ability to do more difficult tasks’. A few had specific difficulties with Excel; ‘I am confident to a point, however when students encounter more obscure difficulties, such as formatting graphs in Excel, I struggle to support them in finding the answer to their problem,’ and, ‘It would be beneficial to be more proficient in Excel, for teaching statistics’. While one respondent admitted that they had very limited skills, ‘I can’t clearly explain to students the differences between the Intranet and the Internet or between saving files to the network versus their computer’.

There was mention of four other barriers, one was age related. Others were school expectations and combined skills of the teachers within the school. ‘Our school implements new programs and we are expected to know how to use them so that we can explain how to students’ and, ‘Our level of IT capability affects the level utilised in the school’. Additionally, the lack of, or limited, knowledge of computing tools affected a few respondent’s abilities. ‘I don’t know functions on the students’ Netbooks,’ or were limited to particular devices such as ‘CAS Calculators and Electronic Whiteboards’.

Comments provided by two respondents summed up the connection between the level of computer education knowledge and a teacher’s ability to transfer this to students. ‘The more competent you are in an area, the more capable you would be to break down the skills and teach them to others,’ and, ‘Teacher skill levels will dictate the degree to which technology is modelled in real-life learning’. A few respondents accepted that no one can have all the answers and that some students do have more computer knowledge than some teachers do.

7.3: Past Computing Professional Development Experiences
The questionnaire inquired about respondents’ participation in past computing PD and what experiences they had with ICT PD.

7.3.1: Participation in Past Professional Development
This question sought details on how much computing professional development
respondents had taken part in. Interestingly almost 75% had not attended any or not enough ICT PD sessions (Table 7.8).

<table>
<thead>
<tr>
<th>PD Attended</th>
<th>n</th>
<th>%²</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>6</td>
<td>17%</td>
</tr>
<tr>
<td>Not enough</td>
<td>21</td>
<td>58%</td>
</tr>
<tr>
<td>Enough</td>
<td>6</td>
<td>17%</td>
</tr>
<tr>
<td>Many</td>
<td>2</td>
<td>5.5%</td>
</tr>
<tr>
<td>A great many</td>
<td>1</td>
<td>3%</td>
</tr>
</tbody>
</table>

Table 7.8: Respondents attendance in ICT PDs

An additional question enquired if respondents had ever presented at a computing PD session. Less than a third of the respondents had delivered PD in computing.

7.3.2: Past Professional Development Usefulness

The respondents were questioned on the usefulness of past computing PD sessions and if these met their needs, and whether they were at an appropriate knowledge level for them. Around two-thirds of the respondents replied sometimes or less to both of these, and the remainder indicated that they often or most of the time met these criteria. No respondent indicated that past computing PD had always achieved either of these (Table 7.9).

<table>
<thead>
<tr>
<th>Regularity</th>
<th>Meeting Your Needs</th>
<th>Appropriate Level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Rarely</td>
<td>7</td>
<td>24%</td>
</tr>
<tr>
<td>Sometimes</td>
<td>13</td>
<td>45%</td>
</tr>
<tr>
<td>Often</td>
<td>4</td>
<td>14%</td>
</tr>
<tr>
<td>Most of the time</td>
<td>5</td>
<td>17%</td>
</tr>
<tr>
<td>Always</td>
<td>0</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 7.9: Opinions on usefulness of past ICT PD

7.3.3: Problems Encountered with Keeping Skills Up-to-date

In addition to the questions about computing PD participation and usefulness,
respondents were able to add a personal comment on what problems they had encountered in keeping their ICT knowledge up-to-date. There was a large number of responses to this question, with most suggesting multiple reasons.

Many responses mentioned that time was a major problem, time to attend, time for research, time to study, finding time in-between their teaching regime, and time to practice new skills learnt. Without time to consolidate, newly learnt skills were lost, ‘Although I have undertaken training in different programs if I haven’t followed this up with plenty of practice, I tend to forget, and then not use the program’. One respondent said that they did not have the time to search through and rate the sessions on offer, ‘Not prepared to spend the time to determine if a particular session was of high quality’.

Next to time, most respondents referred to the lack of opportunity for, and offer of, ICT PD at their schools. One respondent wrote that ‘I have not been offered many opportunities to complete PD specifically catered to implementing new strategies and computing knowledge within the school’, this reflects most comments made. Another replied that it was up to the individual, the ‘Workplace does not offer enough PD opportunities to keep knowledge up to date, this must be done of [ones] own initiative and in your own time’. At a school where computing PD was lacking, they ‘just expected teachers to know what to do’. A respondent related the lack of PD to time restrictions:

Unless more PDs are dedicated, or a whole departmental/school approach to using ICT is implemented, the best current way is to confer with colleagues. This essential interaction, is once again, restricted by time.

Accessing suitable and appropriate PD with ‘all the demands of teaching’ and the ‘constant changes in technology’ made it difficult ‘to keep up with the latest trends and technology’. ‘There are too many area[s] in computing to stay up to date with, and with new things happening all the time it has become impossible to keep abreast of these changes and to assist others with developing their skills.’ Often respondents had to ‘rely heavily on word of mouth and references to programs in professional publications. There [did] not seem to be a reliable, central association that share[d] this information (across the curriculum)’.
‘Schools and Education Department lagging behind industry in adoption and implementation’ further affected this problem.

Those ICT teachers who taught another subject found it hard to keep up and spent more time updating than those who taught other subjects.

I spend my time staying up to date with programs as an Art teacher and as an ICT teacher. I have to commit a lot of time to it and my teaching practice suffers as a result. No other teaching professional has to remain up to date with the shifting sands of knowledge that is IT. Advancements in most other areas progress slowly or have the occasional jump.

Resourcing at a schools level affected PD availability. Three respondents complained about ‘getting my school to pay for the PD’. A further two indicated that their school’s inefficiency or lack of equipment caused problems with integration. There was a ‘Lack of resources in the school to confidently set up a detailed IT integrated lesson structure’. A school with ‘no ICT teacher’ that had ‘no regular PD in the last few years’ found it difficult to plan lessons as they were ‘unsure of what skills’ students should have. In addition, others felt that there was ‘Not sufficient potential for use [of ICT tools] because of the lack of Technology subjects’, or that ICT PDs were not important because of students’ perceived abilities.

Our school thinks that students are natural computer users so we do not have a technology/IT class. However, our students are not very ICT literate so we have a lot of problems with students not knowing how to use/access programs, organise their files/folders, or save/back up their work.

Other problems mentioned by respondents regarding PD were operational platforms, teachers’ skills, and lack of personal use. The school choice of and use of an ‘Apple platform in a PC world in rural areas is a disadvantage’ because many PDs were PC orientated and it was not easy ‘to adapt skills across’. Teachers’ personal computing skills affected obtaining appropriate PD and understanding conversations. A respondent who was a ‘Software Engineer’ prior to becoming a teacher found it extremely difficult to find PD to suit his abilities.
Another who did ‘not use social network sites’ felt ‘disadvantaged’ and did ‘not fully understand applications students and staff talk[ed] about’.

7.3.4: Reflections on Past Good ICT PD Sessions

Respondents to the questionnaire reflected on three questions on a good computing PD session that they had attended. Twenty-seven responded to the first question of why they thought it was a good session. Responses related to four major categories.

The first category related to relevance. Respondents said that the good PD session they thought about was relevant to their teaching area, included current aspects in use in the classroom, was of current interest, was hands-on and ‘you could see the outcome’. The second category was that the session had met their individual learning needs with sessions ‘extending my existing knowledge’, ‘directed at my level’, set out as to ‘progress at my own pace’, ‘concentrated on things necessary to my work’, had ‘clear and applicable examples for use in the classroom’, and that ‘there was someone there to step us through the program’. Additionally, opportunities existed for networking ‘with colleagues across many different schools and sectors’ and creating ‘workable teaching materials’. The third category related to learning new skills. Different respondents learnt to ‘use the school’s reporting program’ making writing reports easier, learnt about software repositories, the parts of software programs, advanced their understanding, and ‘learned how to do something using up-to-date technology’ that would assist their ‘students do their work to a better standard’. One was impressed with ‘an entire day devoted to’ thoroughly learning ‘one or two particular items’ without rushing, and another with collaboration and ‘instant problem solving of any problems with the site’. The fourth category of pedagogical practice meant that new skills ‘could be passed on to kids’, use ‘new ideas and approaches to classroom practice’ to vary teaching strategies, making classes more engaging, teaching more informed, and ‘deliver regular feedback to students and collect data on student progress’. Respondents also commented on timeliness, accessibility, and flexibility; one was happy to receive ‘detailed notes after the PD so we could revise using our software’.

The second question asked respondents if they were required to do any
preparation for the good computing PD session. Three-quarters replied ‘no’ and the remainder ‘yes’. Those that did undertake preparation indicated that it involved downloading software, signing up, creating accounts, and looking at the program layout. One respondent said that preparation was required for a PD session and had decided not to do it; the respondent noted that ‘if others in the PD session have not done it [and I had,] then I [would] have to wait for them!’ to complete it.

The final question investigated if respondents had received any follow-up after the PD, and most replied ‘no’. The eight respondents who replied positively to his question provided comments about access to a feedback survey, a thank you email, invitations to other sessions, ‘asking for questions to be forwarded’, ‘access to a Blog site for assistance for difficulties,’ and ‘ideas for using digital learning’.

7.3.5: Opinions of Poor Past ICT PD Sessions

Similar questions asked the respondents about a poor computing professional development session, with the respondents providing their perceptions of why they thought the computing PD session was not good. Twenty-four responses related to five categories.

The first category was of overkill. Sessions moved too fast, the presenter was ‘unable to communicate effectively’, and content was over respondents’ heads, ‘I’m not technical and I don’t ‘get’ it as easily as some’. One respondent complained of too much at once, ‘Too much emphasis on bells and whistles in a short time-span. A great buzz for the brain but insufficient time to really understand and remember what was presented’. Inappropriateness was the second category. Sessions covered equipment not yet used within the school, content covered was not practical for classroom use, the presenter ‘lectured’ and made assumptions about attendees’ knowledge, and information was future orientated and soon forgotten. ‘Limited’ was the only way to describe the third category. No time allocation for ‘practice or play’ was included in the session, aspects were explained ‘in a confined way’, and the session only covered already known knowledge. ‘Nothing new was learnt and no new ideas were given’. One session happened without attendees having a computer, and when did obtain access, they
had forgotten things. At another session, the ‘Internet crashed’ with system overload as ‘All schools were learning it the same day’. Some respondents reported that poor PD sessions were time wasters - the fourth category; perceived poor sessions were a ‘talk fest,’ had ‘no hands on’, wasted time on interface navigation and not on application capability, or were a ‘thinly disguised sales pitch for software’. A respondent was concerned over ‘a waste of time, as we require more skills that are essential for our students’. The final category for poor PD sessions was boring. Respondents wrote that ‘Boring, the program was not given any context for learning, old school technology in a modern setting,’ and the instructor was clueless, ‘it was boring’.

The two accompanying questions on preparation and follow-up received one response each, the preparation required ‘Lots of expected reading,’ and the follow-up ‘Generally follow-up quizzes or questionnaires that give nothing back to the teacher’.

**7.3.6: Past Professional Development Reflections**

The final question for this segment sought out any additional comments respondents wished to make on past computing PD or computing skills. A response was, ‘Teachers do not receive enough PD here’. Two replied that it was up to them to pursue appropriate ICT PD in their own time for skill development, ‘possibly easier to do in your own time using your own equipment. Online PDs’. One confirmed that his/her school was severely under-resourced in computer equipment for 850 students, with only ‘overhead projectors in every second classroom, some class Laptop sets, and three Electronic Whiteboards’.

**7.4: Future Computing Professional Development Desires**

The fourth section of the questionnaire inquired about respondents’ future preferences for computing PD in relation to delivery methods, content, timing, regularity, duration, distance and cost. Sections 7.4.1 to 7.4.8 incorporate mean values. A description of the mean, or average and its calculation method is in Section 3.6.2.4. Using Anderson, Sweeney and Williams (2006) directions to calculate the mean (see Section 3.6.2.4), the mean for this section is three.
7.4.1: Future Online ICT Professional Development

The first question in this section asked respondents if they thought that they might undertake computing PD via an online method in the future and what form that would take (Table 7.10). Viewing YouTube clips had the highest overall preference, with online exemplars equating to ‘prefer’. Preferences for the remaining options of interactive online resources, online education department documents, Webcasts, Podcasts, online forums, static resources, and video conferences appeared between slightly preferred and preferred. Overall, video conferencing was the least preferred option.

<table>
<thead>
<tr>
<th>Online Source</th>
<th>Preference</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>None</td>
<td>Slightly</td>
</tr>
<tr>
<td>YouTube clips</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Online Exemplars of computer use in other classes</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>Interactive online resources (webinar)</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>Online documents/tutorials provided by an education department</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>Webcasts / Podcasts</td>
<td>7</td>
<td>11</td>
</tr>
<tr>
<td>Online forums</td>
<td>8</td>
<td>14</td>
</tr>
<tr>
<td>Static online resources (help sheets)</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>Video conference</td>
<td>15</td>
<td>8</td>
</tr>
</tbody>
</table>

Table 7.10: Preferences for online delivery methods of ICT PD

7.4.2: Future Face-to-Face ICT Professional Development

Responding teachers selected their preferences for possible future opinions of ICT PD in face-to-face delivery situations. Table 7.11 details the responses and shows that specific workshops tailored to particular computing concepts, were the most preferred, closely followed by PD sessions located at the teacher’s employed
school. The least preferred option overall was a presentation from a consultant. The remaining options averages were in between a slight preference and preferred.

<table>
<thead>
<tr>
<th>Face-to-face source</th>
<th>None</th>
<th>Slightly</th>
<th>Prefer</th>
<th>Strongly</th>
<th>Very Strongly</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific workshops</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>19</td>
<td>7</td>
<td>3.88</td>
</tr>
<tr>
<td>PD located at your school</td>
<td>4</td>
<td>4</td>
<td>10</td>
<td>9</td>
<td>6</td>
<td>3.27</td>
</tr>
<tr>
<td>Conference attendance</td>
<td>7</td>
<td>6</td>
<td>8</td>
<td>10</td>
<td>2</td>
<td>2.82</td>
</tr>
<tr>
<td>PD not located at your school</td>
<td>4</td>
<td>12</td>
<td>7</td>
<td>9</td>
<td>1</td>
<td>2.73</td>
</tr>
<tr>
<td>One-on-one consultation with school staff</td>
<td>9</td>
<td>7</td>
<td>7</td>
<td>5</td>
<td>5</td>
<td>2.70</td>
</tr>
<tr>
<td>School employee presented</td>
<td>11</td>
<td>5</td>
<td>12</td>
<td>4</td>
<td>1</td>
<td>2.36</td>
</tr>
<tr>
<td>Seek information from a family member or friend</td>
<td>14</td>
<td>5</td>
<td>7</td>
<td>5</td>
<td>2</td>
<td>2.27</td>
</tr>
<tr>
<td>Consultancy presented</td>
<td>11</td>
<td>9</td>
<td>9</td>
<td>3</td>
<td>1</td>
<td>2.21</td>
</tr>
</tbody>
</table>

Table 7.11: Preferences for face-to-face delivery methods of ICT PD

### 7.4.3: Future Formal ICT Professional Development

The third delivery method question on future ICT PD asked about formal delivery methods. Formal delivery methods comprise of courses that respondents would receive certification for once successfully completed. Respondents had three options to rate as preferences (Table 7.12). They indicated little difference in their preference for online accredited courses and accredited courses they could attend. Most did not prefer PD conducted through distance education courses.


<table>
<thead>
<tr>
<th>Accredited Course Delivery</th>
<th>None</th>
<th>Slightly</th>
<th>Prefer</th>
<th>Strongly</th>
<th>Very Strongly</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Online</td>
<td>6</td>
<td>4</td>
<td>12</td>
<td>7</td>
<td>4</td>
<td>2.97</td>
</tr>
<tr>
<td>Attend face-to-face</td>
<td>6</td>
<td>4</td>
<td>12</td>
<td>9</td>
<td>2</td>
<td>2.91</td>
</tr>
<tr>
<td>Conducted via mail</td>
<td>21</td>
<td>8</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>1.55</td>
</tr>
</tbody>
</table>

Table 7.12: Preferences for formal delivery methods of ICT PD

**7.4.4: Other Comments on Future ICT Professional Development**

An opportunity occurred for survey respondents to add any other information in relation to future computing PD delivery methods. Three teachers responded. One replied that *There is no correct form of PD delivery, but there is a massive need for teachers to have the time to meet their own needs*. Another suggested where to find PD information, *I use Coursera*. Coursera, formed in 2012, offers massive open online universities courses at three levels. Short courses last for four to six weeks, specialisation courses take four to six months, and online degrees take between one to three years (Coursera 2016). Moreover, the third included details of content that they would like to learn or improve his/her abilities, *Just basic things like setting up tables, laying out documentation quickly and effectively*.

**7.4.5: Future Content Fit of ICT Professional Development**

An associated question regarded the sort of content fit that respondents wished for in future PD sessions (Table 7.13). Nearly all of the respondents indicated a strong preference for content that fit their teaching needs. Content that fit their personal needs and the curriculum were also highly rated. School priorities were considered somewhat less important and covering a broad range of concepts was only slightly preferred. The least preferred content fit was a session on a single concept.
### Table 7.13: Preferences for ICT PD content fit

<table>
<thead>
<tr>
<th>PD Content</th>
<th>None</th>
<th>Slightly</th>
<th>Prefer</th>
<th>Strongly</th>
<th>Very Strongly</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Content that fits your teaching needs</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>16</td>
<td>15</td>
<td>4.39</td>
</tr>
<tr>
<td>Content that fits your personal needs</td>
<td>1</td>
<td>2</td>
<td>9</td>
<td>12</td>
<td>9</td>
<td>3.79</td>
</tr>
<tr>
<td>Content that fits the curriculum</td>
<td>0</td>
<td>3</td>
<td>8</td>
<td>16</td>
<td>6</td>
<td>3.76</td>
</tr>
<tr>
<td>Content that fits school priorities</td>
<td>5</td>
<td>5</td>
<td>6</td>
<td>10</td>
<td>7</td>
<td>3.27</td>
</tr>
<tr>
<td>A session on a broad range of concepts</td>
<td>7</td>
<td>6</td>
<td>9</td>
<td>9</td>
<td>2</td>
<td>2.79</td>
</tr>
<tr>
<td>A session on a single concept</td>
<td>9</td>
<td>9</td>
<td>5</td>
<td>7</td>
<td>3</td>
<td>2.58</td>
</tr>
</tbody>
</table>

7.4.6: Future Timing of ICT Professional Development

Having provided preferences for delivery methods and content fit, respondents replied to preferences for the timing of computing PD sessions (Table 7.14). The most popular preference was on student free days, closely followed by during school hours and immediately after school. The balance of options for timing of ICT PD was not high on their preference list, although a select few were interested in undertaking ICT PD during free periods or during school holidays. Only one respondent preferred before school as an option.
When held | Preference | Mean |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>Slightly</td>
<td>Prefer</td>
</tr>
<tr>
<td>On student free days</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>During school hours</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Immediately after school</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>On school days during free periods</td>
<td>19</td>
<td>8</td>
</tr>
<tr>
<td>During school holidays</td>
<td>24</td>
<td>4</td>
</tr>
<tr>
<td>In the evenings</td>
<td>22</td>
<td>8</td>
</tr>
<tr>
<td>On the weekend</td>
<td>28</td>
<td>2</td>
</tr>
<tr>
<td>Before school</td>
<td>30</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 7.14: Preferences for when ICT PD held

### 7.4.7: Future Regularity of ICT Professional Development

A question asked respondents about how often they wished to undertake future computing PD (Table 7.15). Overall, the most popular response from respondents was regular sessions throughout the year. However, other regular options such as once a term, and sessions during one or two terms, rated well.

<table>
<thead>
<tr>
<th>How often held</th>
<th>Preference</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>Slightly</td>
<td>Prefer</td>
</tr>
<tr>
<td>Regularly throughout the year</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Once during each term</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Regularly during two terms</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>Regularly during one term</td>
<td>7</td>
<td>11</td>
</tr>
<tr>
<td>Only once</td>
<td>24</td>
<td>8</td>
</tr>
<tr>
<td>Not at all</td>
<td>31</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 7.15: Preferences for future offering of ICT PD
7.4.8: Future Duration for ICT Professional Development

This question on future professional development enquired about the length of PD sessions (Table 7.16). The preferred options were two-hour sessions and half-day sessions. The least popular option was for ICT PD that ran for more than one day.

<table>
<thead>
<tr>
<th>Length of time</th>
<th>Preference</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sessions that last for up to two hours</td>
<td>None</td>
<td>3.00</td>
</tr>
<tr>
<td></td>
<td>Slightly</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Prefer</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>Strongly</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Very Strongly</td>
<td>2</td>
</tr>
<tr>
<td>A half-day session</td>
<td>None</td>
<td>2.69</td>
</tr>
<tr>
<td></td>
<td>Slightly</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Prefer</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Strongly</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Very Strongly</td>
<td>1</td>
</tr>
<tr>
<td>Short sessions of less than one hour</td>
<td>None</td>
<td>2.32</td>
</tr>
<tr>
<td></td>
<td>Slightly</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Prefer</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Strongly</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Very Strongly</td>
<td>5</td>
</tr>
<tr>
<td>A full day session</td>
<td>None</td>
<td>2.32</td>
</tr>
<tr>
<td></td>
<td>Slightly</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Prefer</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Strongly</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Very Strongly</td>
<td>1</td>
</tr>
<tr>
<td>Sessions run over successive days</td>
<td>None</td>
<td>2.19</td>
</tr>
<tr>
<td></td>
<td>Slightly</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Prefer</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Strongly</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Very Strongly</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 7.16: Preferences for length of time for ICT PD

7.4.9: Future Travelling Distances for ICT PD

Respondents shared thoughts on distances they would be willing to travel for future computing PD (Table 7.17). Nearly all of the respondents selected the shorter distances of less than 100 kilometres with few being willing to travel more than 100 km. No teacher restricted PD opportunities to only their employed school.

<table>
<thead>
<tr>
<th>Distance</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Only to my employed school</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>Less than 50 km</td>
<td>20</td>
<td>63%</td>
</tr>
<tr>
<td>51 to 100 km</td>
<td>9</td>
<td>28%</td>
</tr>
<tr>
<td>101 to 150 km</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>151-200 km</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td>201 to 500 km</td>
<td>2</td>
<td>6%</td>
</tr>
<tr>
<td>&gt; 500 km</td>
<td>0</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 7.17: Responses to distance willing to travel for future ICT PD
7.4.10: Future Costs of ICT Professional Development

The final question on future computing PD enquired about how much the respondents would be willing to contribute (Table 7.18). The majority of respondents opted to pay either nothing (as the school should pay for PD and travel) or travel expenses only (as the school should pay for the PD). Some respondents were willing to spend up to $200, but nothing over that amount.

<table>
<thead>
<tr>
<th>Cost</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>No amount</td>
<td>8</td>
<td>25%</td>
</tr>
<tr>
<td>Travel expenses only</td>
<td>15</td>
<td>47%</td>
</tr>
<tr>
<td>Under $50</td>
<td>2</td>
<td>6%</td>
</tr>
<tr>
<td>$51 to $100</td>
<td>4</td>
<td>13%</td>
</tr>
<tr>
<td>$101 to $200</td>
<td>3</td>
<td>9%</td>
</tr>
<tr>
<td>$201 to $300</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>&gt; $300</td>
<td>0</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 7.18: Amounts willing to contribute to future ICT PD

7.5: Summary of Chapter 7

This chapter provided the results of an online questionnaire that formed the second phase of data collection for this research project. The questionnaire collected information from schoolteachers about themselves, their schools, their ICT skills, their past ICT PD experiences, and their future wishes for ICT PD. The sections of this chapter introduced the sub-categories. The next chapter will discuss these results and investigate relationships between the questionnaire segments.
Chapter 8: Survey Discussion

The previous chapter introduced the sub-categories to the core categories through univariate analysis. This chapter incorporates bivariate analysis of cross-tabulation to search for significant relationships between the sub-categories and respondent groups, and between sub-categories of the core categories. This chapter discusses the collected questionnaire data and evaluates the variable relationships.

Generalisation limitations of the research were described in Section 3.10; these detail that the outcomes should not be viewed as applicable to the broader population. The findings of this chapter, and any inferences provided are therefore limited to the sample.

8.1: Collapsing Data Categories

The respondents to the questionnaire represented a good range of teachers and covered most aspects of the questions asked. However, due to the overall low response rate, some question categories attracted none or few responses and therefore contributed to violating the 80% rule for expected cell counts of less than five for cross-tabulation analysis (see Section 3.6.2.4) (Kirkpatrick & Feeney 2003; Pallant 2011). To overcome this problem, reduction of most variable categories occurred and used for analysis (Black 2008; Pallant 2011); descriptions of collapsed variable categories are included below.

After performing category collation and cross-tabulation, the Chi-Square significance value would determine relationship existence. Relationships were evident when the Chi-Square significance value was less than .10 (highlighted in grey). When the value was greater than .10 the groups and/or variables were considered independent of each other (see Section 3.6.2.4).

Creation of groups from collected respondent data on their gender, ICT qualifications, respondent age, teaching years, when introduced to computing and school type occurred. Table 8.1 displays the respondent group formation incorporated into analysis throughout this chapter. Each category column shows the category, the number of responses, and the code numbers used to calculate those responses (see Appendix E.2 for item codes).
<table>
<thead>
<tr>
<th>Group</th>
<th>Category 1</th>
<th>Category 2</th>
<th>Category 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Male (8)</td>
<td>Female (24)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Code number 1</td>
<td>Code number 2</td>
<td></td>
</tr>
<tr>
<td>Qualification</td>
<td>ICT qualified (7)</td>
<td>Not-ICT qualified (25)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Code number 1</td>
<td>Code number 2</td>
<td></td>
</tr>
<tr>
<td>Respondent Age</td>
<td>30 years or less (12)</td>
<td>31 years or more (20)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Code number 1</td>
<td>Code numbers 2 to 5</td>
<td></td>
</tr>
<tr>
<td>Teaching Years</td>
<td>5 years or less (16)</td>
<td>6 years or more (16)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Code number 1</td>
<td>Code numbers 2 to 6</td>
<td></td>
</tr>
<tr>
<td>Introduced</td>
<td>Before secondary school (14)</td>
<td>At secondary school (7)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Code numbers 1 to 2, and 8</td>
<td>Code number 3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>After secondary school (11)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Code numbers 4 to 7</td>
<td></td>
</tr>
<tr>
<td>School Type</td>
<td>Government (28)</td>
<td>Non-government (8)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Code number 2</td>
<td>Code numbers 1, 3, and 4</td>
<td></td>
</tr>
</tbody>
</table>

Table 8.1: Respondent group formation

### 8.2: Respondents

Respondents seemed very honest in their replies, as they were forthcoming in providing valuable information, with many giving personal thoughts and experiences. Those who taught in a specialist area taught in up to three of 15 compulsory and eight post-compulsory subjects represented; nine respondents taught a single subject, 14 taught two subjects, and four taught three subjects. Some respondents taught across unrelated discipline areas, such as Science and Humanities or Science and Languages, while others taught in related areas such as Science and Mathematics, or English and Humanities. These subjects exhibit a wide range of discipline interests of the respondents. Four of the respondents older than 31 years had taught for less than six years, indicating that they may have begun teacher training as mature aged students (see Section 7.1).

Of the seven ICT teachers who had formal ICT qualifications, only five taught ICT or an ICT related subject such as media, web design, multimedia or VCE IT. These respondents also taught subjects such as Art, Mathematics, Commerce, Science, Technology (other than ICT), or VCE Systems Engineering, Business Studies, Physics or Mathematical areas. Two of the ICT qualified ICT teachers were not currently teaching any computing, they taught in Mathematics/Science
and Commerce/Mathematics areas. One respondent was teaching ICT and Mathematics without formal qualifications in computing.

Comparing the interview participants with the survey respondents revealed that each research phase had a similar percentage of school type representation and teachers genders. The survey had a slightly higher percentage of government schools (77%) and females (75%) represented than the interviews (70%; 70%). However, differences did occur in teachers’ length of time teaching. The survey had much more teachers of five years or less experience (50%) than were included in the interviews (20%). While, the interviews had twice as many teachers with six to ten years’ experience (30% versus 16%), and more than 20 years teaching experience (30% versus 15%) than the survey. Both the survey and the interviews had a similar number of teachers with 11 to 15 years’ experience (19% and 20% respectively).

Table 8.2 displays the cross-tabulation Chi-Square results for respondent groups highlighting five relationships. Although female distribution was almost even between the two age categories, most male respondents were over 31 years of age. Most respondents aged 30 or less had taught for fewer than six years, whereas three-quarters of those over 30 had taught for six years or more. Many of the respondents under 31 first used computers before entering secondary school, however more than half of those over 31 first accessed them after leaving secondary school. Of those who had been teaching for five years or less, most had first accessed computers before secondary school, and 56% of those teaching six years or more first accessed them after leaving secondary school. As expected, most younger teachers would have less teaching experience than older teachers would; those that were younger would have been born in or after 1983 (data collected 2013 less 30 years) and most likely exposed to computers in primary school. Surprisingly, respondents who were ICT qualified tended to first use computers after leaving secondary school, and for those not-ICT qualified their first computer use was more likely to be before they entered into secondary school or while at secondary school. There seems to be an indication that the earlier respondents’ first accessed computers and the longer they had used them, the less interested they were in gaining ICT teacher qualifications.
<table>
<thead>
<tr>
<th>Qualification</th>
<th>Gender</th>
<th>Qualification</th>
<th>Respondent Age</th>
<th>Teaching Years</th>
<th>Introduced</th>
</tr>
</thead>
<tbody>
<tr>
<td>.217</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Respondent Age</td>
<td>.092</td>
<td>.151</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(25%)</td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Teaching Years</td>
<td>.414</td>
<td>.669</td>
<td>.000 (0%)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Introduced</td>
<td>.436</td>
<td>.050 (50%)</td>
<td>.004 (50%)</td>
<td>.010 (33%)</td>
<td>-</td>
</tr>
<tr>
<td>School Type</td>
<td>.805</td>
<td>.583</td>
<td>.151</td>
<td>.200</td>
<td>.656</td>
</tr>
</tbody>
</table>

Table 8.2: Cross-tabulation results of respondent groups

8.3: Skills Discussion

Table 8.3 shows the combination of Skills variables code categories, organised similarly to those in Table 8.1.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Category 1</th>
<th>Category 2</th>
<th>Category 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regularity</td>
<td>Less than once a day (10) Code numbers 1 to 4</td>
<td>More than once a day (26) Code number 6</td>
<td>-</td>
</tr>
<tr>
<td>Student Use</td>
<td>3 years or less (18) Code numbers 1 and 2</td>
<td>4 years or more (18) Code numbers 3 to 6</td>
<td>-</td>
</tr>
<tr>
<td>Own Skill</td>
<td>Intermediate (15) Code number 3</td>
<td>Advanced (21) Code numbers 4 and 5</td>
<td>-</td>
</tr>
<tr>
<td>Often Concepts</td>
<td>Sometimes or less (19) Code numbers 1 to 3</td>
<td>More often than sometimes (17) Code numbers 4 and 5</td>
<td>-</td>
</tr>
<tr>
<td>Sufficiency</td>
<td>Often or less (12) Code numbers 1 to 3</td>
<td>More than often (24) Code numbers 4 and 5</td>
<td>-</td>
</tr>
<tr>
<td>Impact</td>
<td>Yes (29) Code number 1</td>
<td>No (7) Code number 2</td>
<td>-</td>
</tr>
<tr>
<td>Preparedness</td>
<td>Less than prepared (10) Code numbers 1 and 2</td>
<td>Moderately prepared (15) Code number 3</td>
<td>More than prepared (11) Code numbers 4 and 5</td>
</tr>
</tbody>
</table>

Table 8.3: Combination of skill variable categories
8.3.1: Computer Use

Most respondents were prolific users of computing tools in the classroom; however, a few were irregular users, and one a non-user (see Section 7.2.1). All the respondents reported that students have used computers for schoolwork in the classroom throughout the last decade, although the length of time varied greatly between schools (see Section 7.2.1). The last few years had seen an explosion of student computing use with half of the students using computing tools in the classroom for three years or less, and 72% for six years or less. The recent increase in student use in the classroom could be due to schools transitioning toward one-to-one access and the implementation of the NSSCF component of the DER (see Sections 2.3.1.2 & 5.1.4). A few respondents recognised that students’ computer knowledge level was dependent on their teachers’ ability, and a few accepted that some students had more computer knowledge than they did.

Table 8.4 shows relationships for computer use and respondent groups. Respondents from non-government schools were more likely to use computers less than once a day, while at government schools it was more likely respondents used computers more than once a day. Interestingly, government schools were more reliant on technology use than non-government schools. In schools where students have been using computers for up to three years, the students were most likely to be in classes where respondents were aged 30 or less and with five years or less experience. Whereas, in schools where students had used computers in the classroom for more than three years, respondents were more likely to be over 30 years old and taught for more than five years. This implies that schools that had recently introduced computers for student use had a younger cohort of teachers than schools where students had used computers for longer periods.
<table>
<thead>
<tr>
<th></th>
<th>Gender</th>
<th>Qualification</th>
<th>Respondent Age</th>
<th>Teaching Years</th>
<th>Introduced</th>
<th>School Type</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Regularity</strong></td>
<td>.805</td>
<td>.583</td>
<td>.581</td>
<td>.669</td>
<td>.656</td>
<td>.013 (25%)</td>
</tr>
<tr>
<td><strong>Student Use</strong></td>
<td>.414</td>
<td>.669</td>
<td>.000 (0%)</td>
<td>.000 (0%)</td>
<td>.349</td>
<td>.423</td>
</tr>
<tr>
<td><strong>Own Skill</strong></td>
<td>.133</td>
<td>.030 (50%)</td>
<td>.501</td>
<td>.710</td>
<td>.394</td>
<td>.786</td>
</tr>
<tr>
<td><strong>Often</strong></td>
<td>.539</td>
<td>.272</td>
<td>.784</td>
<td>.723</td>
<td>.820</td>
<td>.532</td>
</tr>
<tr>
<td><strong>Sufficient</strong></td>
<td>.256</td>
<td>.061</td>
<td>.761</td>
<td>.238</td>
<td>.294</td>
<td>.571</td>
</tr>
<tr>
<td><strong>Preparedness</strong></td>
<td>.639</td>
<td>.125</td>
<td>.694</td>
<td>.638</td>
<td>.530</td>
<td>.270</td>
</tr>
<tr>
<td><strong>Impact</strong></td>
<td>.626</td>
<td>.379</td>
<td>.959</td>
<td>.574</td>
<td>.912</td>
<td>.399</td>
</tr>
</tbody>
</table>

Table 8.4: Cross-tabulation results of respondent groups and skill variables

Relationships of computer use were evident when cross-tabulating skills variables with themselves (Table 8.5). In schools where students had used computers for three years or less, just over half of the respondents rated their skill level as intermediate, whereas for schools where student use was more than three years the respondents reported more advanced skill levels. As was to be expected, those respondents that used computer tools in teaching less than once a day all reported that they rarely taught computing concepts and were less sufficiently skilled at teaching computer concepts than those who said they used them more than once a day, taught concepts more often and were more sufficiently skilled. Of all the respondents, 60% of those who used computers less than once a day and 89% of those who used them more than once a day indicated that their computing skills did influence the way they taught computing, however, this does not indicate if the effect had a positive or negative impact.
Chapter 8

Regularity

Student Use

Own Skill

Often

Sufficiency

Preparedness

<table>
<thead>
<tr>
<th></th>
<th>Regularity</th>
<th>Student Use</th>
<th>Own Skill</th>
<th>Often</th>
<th>Sufficiency</th>
<th>Preparedness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regularity</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Student Use</td>
<td>1.00</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Own Skill</td>
<td>.166 (.25%)</td>
<td>.091 (0%)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Often</td>
<td>.000 (0%)</td>
<td>.317</td>
<td>.158</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Sufficient</td>
<td>.035 (.25%)</td>
<td>.480</td>
<td>.000 (0%)</td>
<td>.009 (0%)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Preparedness</td>
<td>.112</td>
<td>.318</td>
<td>.016 (33%)</td>
<td>.112</td>
<td>.003 (33%)</td>
<td>-</td>
</tr>
<tr>
<td>Impact</td>
<td>.053 (.25%)</td>
<td>.206</td>
<td>.943</td>
<td>.797</td>
<td>.551</td>
<td>.534</td>
</tr>
</tbody>
</table>

Table 8.5: Cross-tabulation results of skill variables

8.3.2: Evaluating Computer Concepts

The respondents were generally confident with their own computer skills and rated their skills at an intermediate level or above; although, when it came to teaching computing concepts only about half regularly did so (see Sections 7.2 & 7.2.2). Possible explanations for this could be the variation in the ICT integration, the teacher not having the knowledge, the subject did not utilise computing tools, students knew what they were doing, students found out how to from their peers, students did their work another way or did not do the work. Those respondents who were ICT qualified all rated their skill level as advanced, while only 56% of those not qualified rated their skills at this level (Table 8.4). This indicates that not all non-ICT teachers would regularly seek out assistance from ICT teachers; this finding both contrasts and concurs with interview participants comments of assisting teachers with computing concepts. Twice as many respondents considered themselves sufficiently skilled in teaching computing concepts to students in their classes than those who did not (see Section 7.2.2). Most of the respondents who indicated they had advanced skills considered that they had more than sufficient skills to teach computing concepts, whereas, for those with intermediate skills only 67% considered their sufficiency to teach concepts at often or less (Table 8.5). Therefore, respondents with advanced skills were more confident to teach ICT concepts.

Computer confident respondents had the knowledge to teach ICT concepts, were
not afraid to tackle new things, did not have issues when assisting students with computing concepts, and made sure students understood what they were learning by going into further detail and explanations (similar to the interviewees in 4.2.5.1). Those who were not confident to be able to teach concepts had rated their skills lower than those who were. Respondents who did not often teach computer concepts considered their skill sufficiency to be 35% lower than those who taught concepts more often and rated their skill sufficiency at a higher level (Table 8.5).

Although many respondents considered themselves prepared for Digital Technologies in the national curriculum, just over a quarter did not (see Section 7.2.2). Table 8.4 showed no relationship of preparedness with any respondent group, however, Table 8.5 showed relationships between sufficiency and preparedness, and own skill and preparedness. Delving further into these variables revealed that those respondents who consider that they had lower skills and less sufficiency were less prepared for teaching Digital Technologies in the national curriculum than those of higher skills and more proficiency (Table 8.6). Schools will need to assist teachers to improve their skills; otherwise, teachers and students will struggle with Digital Technology.

<table>
<thead>
<tr>
<th>Sufficiency</th>
<th>Preparedness</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Less prepared</td>
</tr>
<tr>
<td>Often or less</td>
<td>58%</td>
</tr>
<tr>
<td>More than Often</td>
<td>12%</td>
</tr>
<tr>
<td>Own Skill</td>
<td></td>
</tr>
<tr>
<td>Intermediate</td>
<td>47%</td>
</tr>
<tr>
<td>Advanced</td>
<td>14%</td>
</tr>
</tbody>
</table>

Table 8.6: Cross-tabulation of preparedness with sufficiency and own skills

### 8.3.3: Impact Statement Evaluation

The statements that the respondents provided (see Section 7.2.4) on whether their computing skill level impacted on the way they taught computing were thematically coded into computer knowledge, content, confidence, and devices (Table 8.7). Many of the comments contained more than one of these codes. The
comments ranged in emotions and covered respondents elations, capabilities, acceptances, fears, and limitations, and divided into enabling or inhibiting comments. Overall, knowledge codes made up the largest percentage, followed by content and then confidence. Enabling codes accounted for a greater proportion than inhibiting codes. Of the enabling codes, 41% were knowledge, 34% content, and 25% computer confidence; respondents did not mention any enabling comments for devices. Of the inhibiting codes, 47% were knowledge, 22% content, 25% confidence, and 6% devices. The inhibiting results show that knowledge codes amounted to almost half of respondents’ concerns and made up the same amount as for content and confidence combined. Table 8.7 indicates that there were similar numbers of enabling comments for computer knowledge and computer confidence as there was for inhibiting comments, however, there was twice the number of enabling content comments as inhibiting ones. These results indicate that respondents considered their computer knowledge to have a greater influence on their computing teaching than either content or confidence.

<table>
<thead>
<tr>
<th></th>
<th>Knowledge n (%)</th>
<th>Content n (%)</th>
<th>Confidence n (%)</th>
<th>Devices n (%)</th>
<th>Total n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enabling comments</td>
<td>18</td>
<td>15</td>
<td>11</td>
<td>-</td>
<td>44 (58%)</td>
</tr>
<tr>
<td>Inhibiting comments</td>
<td>15</td>
<td>7</td>
<td>8</td>
<td>2</td>
<td>32 (42%)</td>
</tr>
<tr>
<td>Total</td>
<td>33 (43%)</td>
<td>22 (29%)</td>
<td>19 (25%)</td>
<td>2 (3%)</td>
<td>76 (100%)</td>
</tr>
</tbody>
</table>

Table 8.7: Coded impact comments

### 8.3.4: Limitations and Assumptions

Some respondents accepted their limitations, no matter what their own skill level was and recognised that not one person would know everything in relation to ICT education. Others acknowledged their limitations and shortcomings and admitted they had problems when it came to supporting students. They tended to stay within their comfort zone and with programs that were familiar, recognising their fears and limitations in relation to computing education content, student devices, their level of knowledge, and confidence with computers.

A few respondents mentioned that some schools made assumptions, such as
teachers had the necessary ICT knowledge, teachers knew all about the devices in use at their school and the programs implemented for student use, or that students were native computer users and had no need for ICT classes. However, often these assumptions were unfounded, as shown by the information presented in this research project.

8.3.5: Core Computing Classes

Many of the respondents saw the need for core computing classes as essential (see Section 7.2.3). They indicated that they considered these classes were important and indispensable to ensure students were ICT literate and preferred that students learnt computing skills in this type of class. These results show that respondents indicate a perceived need for core computer classes still exists, despite the integration of teaching computing concepts into other subjects.

8.4: Past Professional Development Discussion

Combined variable responses for questions in this section are in Table 8.8.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Category 1</th>
<th>Category 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Past Participation</td>
<td>Less than enough (27)</td>
<td>Enough or greater (9)</td>
</tr>
<tr>
<td></td>
<td>Code numbers 1 and 2</td>
<td>Code numbers 3 to 5</td>
</tr>
<tr>
<td>Past Needs</td>
<td>Sometimes or less (20)</td>
<td>Often or greater (9)</td>
</tr>
<tr>
<td></td>
<td>Code numbers 1 and 2</td>
<td>Code numbers 3 to 5</td>
</tr>
<tr>
<td>Past PD level</td>
<td>Sometimes or less (18)</td>
<td>Often or greater (11)</td>
</tr>
<tr>
<td></td>
<td>Code numbers 1 and 2</td>
<td>Code numbers 3 to 5</td>
</tr>
<tr>
<td>Past Presented</td>
<td>Yes (9)</td>
<td>No (20)</td>
</tr>
<tr>
<td></td>
<td>Code number 1</td>
<td>Code number 2</td>
</tr>
</tbody>
</table>

Table 8.8: Combining past PD experience responses

8.4.1: Past Professional Development Participation

Most respondents considered that they had not attended enough computing PD (see Section 7.3.1); this may be one reason why some teachers were lacking ICT skills. The respondents who indicated that they had not attended any PD sessions consisted of five females and one male. The investigation into the female respondents (Table 8.9) revealed that they all had five years or less of teaching experience and taught varying subjects. Two were not very confident that their
skills were sufficient to teach computing skills, two did not often teach them, and two were underprepared for Digital Technologies in the national curriculum.

<table>
<thead>
<tr>
<th>Subjects Taught</th>
<th>ICT Skill Level</th>
<th>Sufficiency</th>
<th>Often taught</th>
<th>Preparedness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science, Mathematics</td>
<td>Intermediate</td>
<td>More than often</td>
<td>All of the time</td>
<td>Moderately</td>
</tr>
<tr>
<td>History</td>
<td>Advanced</td>
<td>More than often</td>
<td>Sometimes</td>
<td>Under</td>
</tr>
<tr>
<td>Drama, English</td>
<td>Advanced</td>
<td>Less than often</td>
<td>Sometimes</td>
<td>Moderately</td>
</tr>
<tr>
<td></td>
<td>Advanced</td>
<td>More than often</td>
<td>Quite often</td>
<td>Under</td>
</tr>
<tr>
<td>Science, VCE Biology</td>
<td>Intermediate</td>
<td>Less than often</td>
<td>Quite often</td>
<td>Moderately</td>
</tr>
</tbody>
</table>

Table 8.9: Responses from females who had not participated in any ICT PD

The one male responded who had not undertaken any ICT PD had been teaching between 11 and 15 years, taught ICT and Mathematics, considered his skills advanced, taught computing concepts all the time, always considered himself to have sufficient skills to teach computing concepts and was moderately prepared for Digital Technologies. This respondent indicated that he now obtained his knowledge from Coursera (Coursera 2016).

The respondents who indicated that they had not attended enough ICT PD ranged in teaching experience from less than five to greater than 25 years. They taught varying subjects; all but eight considered their skill level sufficient to teach computing concepts, over half did not teach computing concepts very often, and five were underprepared for Digital Technologies. Of those underprepared for Digital Technologies, three were ICT qualified respondents.

When looking into the relationships for past participation as shown in Table 8.10, the respondents who had participated in less than enough PD indicated generally that the PD did not meet their needs or were at an appropriate level; and most had not presented at computing PD. The relationships also showed that of those respondents who had participated in enough or a greater number of professional development sessions, 67% said they were mostly at an appropriate level and just over half said they met their needs or they had presented at a PD session. The
more knowledgeable that respondents were with computing the more satisfied they were with the sessions they had attended; showing either they were very careful in choosing the PD sessions they attended or that they were more comfortable with the content of the session. These respondents were also more willing to share their knowledge through presenting at an ICT PD.

<table>
<thead>
<tr>
<th></th>
<th>Past Participation</th>
<th>Past Needs</th>
<th>Past PD Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Past Needs</td>
<td>.056 (25%)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Past PD Level</td>
<td>.032 (25%)</td>
<td>.000 (25%)</td>
<td>-</td>
</tr>
<tr>
<td>Past Presented</td>
<td>.056 (25%)</td>
<td>.858</td>
<td>.628</td>
</tr>
</tbody>
</table>

Table 8.10: Cross-tabulation of past PD variables

One of the significant relationships shown in Table 8.11 relates to past participation. Many of the respondents who were not-ICT qualified attended fewer ICT PD sessions than those that were, and just over half of those who were ICT qualified had considered they had participated in at least enough sessions.

<table>
<thead>
<tr>
<th></th>
<th>Past Participation</th>
<th>Past Needs</th>
<th>Past PD Level</th>
<th>Past Presented</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>.496</td>
<td>.908</td>
<td>.592</td>
<td>.077 (50%)</td>
</tr>
<tr>
<td>Qualification</td>
<td>.053 (25%)</td>
<td>.266</td>
<td>.143</td>
<td>.077 (50%)</td>
</tr>
<tr>
<td>Respondent Age</td>
<td>.761</td>
<td>.186</td>
<td>.334</td>
<td>.492</td>
</tr>
<tr>
<td>Teaching Years</td>
<td>.694</td>
<td>.390</td>
<td>.500</td>
<td>.234</td>
</tr>
<tr>
<td>Introduced</td>
<td>.587</td>
<td>.049 (67%)</td>
<td>.097 (67%)</td>
<td>.804</td>
</tr>
<tr>
<td>School Type</td>
<td>1.00</td>
<td>.260</td>
<td>.103</td>
<td>.393</td>
</tr>
</tbody>
</table>

Table 8.11: Cross-tabulation of past PD variables and groups

The outcomes presented above suggest that there may be existing relationships between skill and past PD variables, confirmation of seven relationships are in Table 8.12. Past participation revealed two relationships. All of those who had participated in enough or greater PD sessions used computer tools regularly in the classroom, while 63% of those who had not participated in enough PD also did.
Similarly, all of those who participated in enough or greater professional development sessions and 74% of those who participated in less than enough sessions indicated that their computing skill level influenced the way they taught computing education; however to what degree was not able to be determined.

<table>
<thead>
<tr>
<th></th>
<th>Past Participation</th>
<th>Past Needs</th>
<th>Past PD Level</th>
<th>Past Presented</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regularity</td>
<td>.032 (25%)</td>
<td>.988</td>
<td>.976</td>
<td>.026 (25%)</td>
</tr>
<tr>
<td>Student Use</td>
<td>.248</td>
<td>.033 (25%)</td>
<td>.597</td>
<td>.184</td>
</tr>
<tr>
<td>Own Skill</td>
<td>.172</td>
<td>.298</td>
<td>.260</td>
<td>.026 (25%)</td>
</tr>
<tr>
<td>Often</td>
<td>.177</td>
<td>.978</td>
<td>.958</td>
<td>.113</td>
</tr>
<tr>
<td>Sufficiency</td>
<td>.414</td>
<td>.295</td>
<td>.628</td>
<td>.120</td>
</tr>
<tr>
<td>Impact</td>
<td>.089 (25%)</td>
<td>.779</td>
<td>.092 (50%)</td>
<td>.779</td>
</tr>
<tr>
<td>Preparedness</td>
<td>.834</td>
<td>.207</td>
<td>.024 (67%)</td>
<td>.357</td>
</tr>
</tbody>
</table>

Table 8.12: Cross-tabulation of past PD and skill variables

**8.4.2: Past Professional Development Appropriateness**

Respondents viewed many past professional development sessions they had attended as not very useful, most did not meet their needs or were not at an appropriate level for them (see Section 7.3.2). Table 8.10 shows a relationship between past needs and past level of past PD, often when respondents’ needs were unmet, they graded their PD session at an inappropriate level. When their needs were satisfied, they considered the session to be at an acceptable level. The relationship between past PD meeting respondents needs and student length of use in the classroom indicates that the greater their needs were met the longer students had used tools in the classroom and the fewer needs were met the shorter time students at their school had used computing tools in the classroom (Table 8.12).

Irrespective of respondents’ age or years of teaching, similarities were obvious in the relationships of introduction to computers and needs met or level being appropriate (Table 8.11). The longer that respondents had contact with computers the less the PD sessions met their need or were at an appropriate level for them. Respondents who first used computers before entering secondary school indicated that past PD sessions had never met their needs and only rarely were at an
appropriate level. Respondents who began computer use at secondary school indicated that their needs and level appropriateness were only met 40% of the time. Whereas when it came to respondents who first accessed computers after they left secondary school, they viewed the level appropriateness higher (55%) than their needs being met (45%).

Table 8.12 indicated relationships between past PD level appropriateness and respondents preparedness for Digital Technologies in the national curriculum, and past PD level appropriateness and skill level impact on teaching computer concepts. When past PD level was sometimes or less appropriate, 56% of the respondents were moderately prepared, and when the level was often or greater appropriate equal amounts of 45% for less than prepared and more than prepared occurred. All of the respondents who indicated that past PD levels were often or greater appropriate and 78% of those who indicated sometimes or less levels were appropriate said that their computing skill level did impact the way they taught computer concepts, unfortunately, the degree of impact was not recorded.

8.4.3: Presentation of Past Professional Development Sessions

Cross-tabulation analysis of all questionnaire respondents revealed four significant relationships related to presenting at professional development sessions (Tables 8.11 & 8.12). Not surprisingly, just over half of those who were ICT qualified had presented at a PD session compared to one-fifth of those not-ICT qualified. More than half of the males had presented at an ICT PD session, whereas a large proportion of females had not. When comparing those who had presented and used computing tools more than once a day, all of the presenters were regular users, while only 60% of non-presenters were regular users. Of those who presented, most said they had at least advanced skills, whereas only 45% of non-presenters reported this level of skills.

Out of the nine respondents who had presented at a PD session (Table 8.13), the majority were over 31 years of age, from government schools, had advanced skills, and had taught for six years or more. Additionally, half were introduced to computers after they had left secondary school, half were male, and just under half were ICT teachers and had attended at least enough PD sessions (Table 8.13). Most of these respondents thought their skills were sufficient to teach computing
concepts, often taught computing concepts, were prepared for Digital Technologies, and mostly taught in classrooms where students had used computing tools for more than three years. The professional development presenters did not rate PD they had attended very highly, they had not attended that many sessions they considered to be at an appropriate level or attended those that met their needs.

The details in Table 8.13 (not collapsed data) also show that the non-ICT teachers who had presented at a computing PD tended to be younger, taught for a fewer number of years and had attended fewer PD sessions than ICT teachers who presented. This does not provide a good view of ICT education, shows that ICT unqualified teachers have been teaching and instructing in ICT, and confirms the fact that there are not enough ICT qualified teachers. However, because a teacher was not-ICT qualified does not mean that his/her skills were insufficient, as they may have obtained them in other ways.
<table>
<thead>
<tr>
<th>Number</th>
<th>ICT Teachers</th>
<th>Non-ICT Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>2 male</td>
<td>2 male</td>
</tr>
<tr>
<td></td>
<td>2 female</td>
<td>2 female</td>
</tr>
<tr>
<td></td>
<td>1 not answer</td>
<td>1 not answer</td>
</tr>
<tr>
<td>Respondents Ages</td>
<td>3 41-50 years</td>
<td>2 30 years or less</td>
</tr>
<tr>
<td></td>
<td>1 51-60 years</td>
<td>1 31-40 years</td>
</tr>
<tr>
<td></td>
<td>1 not answer</td>
<td>1 51-60 years</td>
</tr>
<tr>
<td>School Type</td>
<td>2 government secondary</td>
<td>5 government secondary</td>
</tr>
<tr>
<td></td>
<td>1 government combined</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 not government combined</td>
<td></td>
</tr>
<tr>
<td>Own Skill Level</td>
<td>2 superior</td>
<td>1 superior</td>
</tr>
<tr>
<td></td>
<td>2 advanced</td>
<td>3 advanced</td>
</tr>
<tr>
<td></td>
<td>1 intermediate</td>
<td></td>
</tr>
<tr>
<td>Teaching Years</td>
<td>2 for 6-10 years</td>
<td>2 for 5 years or less</td>
</tr>
<tr>
<td></td>
<td>1 for 11-15 years</td>
<td>2 for 11-15 years</td>
</tr>
<tr>
<td></td>
<td>1 for greater than 25 years</td>
<td>1 not answer</td>
</tr>
<tr>
<td>Introduced</td>
<td>1 before starting school</td>
<td>2 in primary school</td>
</tr>
<tr>
<td></td>
<td>2 in Post-Graduate studies</td>
<td>1 in secondary school</td>
</tr>
<tr>
<td></td>
<td>1 in the workplace</td>
<td>1 in the workplace</td>
</tr>
<tr>
<td>PD Attended</td>
<td>1 great many</td>
<td>1 not answer</td>
</tr>
<tr>
<td></td>
<td>2 enough</td>
<td>2 enough</td>
</tr>
<tr>
<td></td>
<td>1 not enough</td>
<td>3 not enough</td>
</tr>
</tbody>
</table>

Table 8.13: Respondents who presented at PD sessions

8.4.4: Past Professional Development Positives

Responses relating to good professional development sessions suggested that they were relevant (see Section 7.3.4). Respondents learnt new skills or skills that could extend their existing knowledge through clear examples and hands-on experience. Content from good sessions supplemented their teaching, their use of computing tools within and outside of the classroom, assisted in engaging students and incorporating the material into their classes. Most of the time the sessions met their learning needs and the needs of students in a variety of ways, were level appropriate, were focused on up-to-date information and teaching practices. Good sessions were inspiring, interesting, flexible, appropriate and provided assistance as needed. They were adequately paced, concentrated on few items, progressed
step-by-step, and gave participants time to learn and consolidate the skills. Sometimes attendees received handouts or detailed notes on the software for revision. Presenters knew their material well and clearly explained the content. Additionally, opportunities for networking and collaboration with teachers outside of their own school occurred. Sessions had required limited preparation and provided appropriate follow-up details including future support that could be useful to clarify new software, new concepts learnt, or to get further assistance.

8.4.5: Past Professional Development Difficulties

Attending professional development sessions did not always meet the needs of the respondents. Section 7.3.5 presented five categories that described respondents’ reflections on what they considered a poor PD session. These sessions were uninteresting, uninspiring, irrelevant, inappropriate, and at an unsuitable level. Cramped sessions contained too much information, went too fast and lacked time to consolidate and revisit content. Some sessions overdid a topic or skimmed over a topic, without providing any discussion on applicability or capability of the software. Respondents claimed that some sessions only focused on the aesthetics of a program, were a sales pitch, strayed away from the topic and tasks, or were out-dated. Additional issues complained about were - little new knowledge given, sessions with no hands-on experience, unsuitable content for classroom situations, limited content, or no focus on the individual steps required to produce the desired end-result. Furthermore, respondents mentioned that some sessions were too short, not aligned with school priorities, or did not make effective use of time. Respondents also said that a lack of takeaway resources or notes meant that remembering new information was difficult. Additional comments included an inappropriate selection of instructors, communication issues, lack of equipment and infrastructure support, and sessions covering equipment not used within the school. Lastly, respondents complained of an inappropriate amount of preparation for time-short teachers, and follow-up messages that were useless.

8.4.6: Up-Skilling Problems

Respondents gave many reasons why they had problems keeping computing skills up-to-date (see Sections 7.3.3 & 7.3.6). Generally, teachers had different ICT skill levels and some of the skills they had to learn depended on their subject
specialities. Respondents found that a lack of time had a huge impact on up-skilling, it not only took the time to search for information on ICT PDs but also when they took the time to improve their ICT skills it reduced the time for pedagogical preparation and practice. Some ICT and non-ICT respondents stated that it was difficult sourcing appropriate PD to meet their needs and knowledge level, with little support provided by their schools. Some non-ICT respondents indicated that they wanted to know more about basic ICT concepts. Schools were not providing enough dedicated internal PD for ICT concepts and those that were on offer were not at an appropriate level for those attending. A few respondents indicated that they preferred online professional development to overcome some of these issues.

When it came to respondents seeking PD for ICT concepts and skills, they often had to fend for themselves with little or no assistance from their schools. Some schools expected teachers to ‘confer’ with each other to learn ICT concepts and software operation, rather than through ICT PD. This situation would leave schoolteachers no option but to seek out colleagues, thus confirming comments made by interview participants about assisting other teachers (see Sections 4.2.4.1, 4.2.5.3 & 5.2.2). However, when those teachers’ skills who assisted others were not up-to-date due to inappropriate, little or no PD, the teachers they help will suffer. In a struggle to find suitable PD, respondents mentioned that they had relied on word of mouth and publications for information. Some said that they did not know where to find out what ICT PD was available, they complained about a hard to find, unreliable or non-existent central source containing shared information on professional development.

Respondents mentioned some up-skilling issues relating to their schools. Some schools were under-resourced with computing-related equipment and some respondents claimed they had problems getting schools to fund externally run PD. The lack of technician access hampered infrastructure set-up and maintenance and the low numbers of ICT teachers affected integration and the teaching of ICT concepts. Without the correct resources, unqualified staff would run in-house ICT PD, or ICT PDs would not run at all, therefore contributing to less ICT knowledgeable teachers. There were schools that assumed teachers already had the necessary skills and that teachers would naturally outsource their own PD.
Some respondents complained of not being able to assess the value of new technology and software prior to its implementation into classes when they had to use it.

Many schools opted not to teach core ICT classes, particularly in government secondary schools. The lack of these classes restricts classroom content and ultimately student skills. Some respondents implied that they were unaware of their school's ICT priorities for its students or that their school assumed that its students did not require ICT teaching. Reflecting on the information in Section 2.4.1.1 suggests that schools’ assumption about students’ ICT abilities do not actually reflect actual student abilities.

Additional problems influencing ICT up-skilling were the time delay of new curricula formation and implementation, the gap between educational institutions and the industry, and equipment and software compatibility. Lastly, the dynamic and broad nature of the computing field makes it difficult to keep up. A respondent said that the educational field of ICT moves forward faster than any other teaching area.

8.4.7: Group, Skills and Past PD Relationship Paths

Figure 8.1 shows the relationship pathways between the skills, past PD and respondent group variables.
Figure 8.1: Relationship paths between skills, past PD and group variables

### 8.5: Future ICT Professional Development Preferences

This section investigates the relationships of future ICT PD variables with respondent groups. Collapsed variable responses for this section are in Table 8.14. Most of this section refers to three categories of responses; less preferred, preferred, and more preferred.

---

4 The Key to Figures 8.1

- A green rectangle represents a group variable
- A blue ellipses represent a Past PD variable
- A yellow rounded rectangles represent a Skills variable
Table 8.14: Combining future PD wishes responses

<table>
<thead>
<tr>
<th>Variable</th>
<th>Sub-questions</th>
<th>Category 1</th>
<th>Category 2</th>
<th>Category 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Future Online</td>
<td>8</td>
<td>Less preferred</td>
<td>Preferred</td>
<td>More preferred</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Code numbers 1 and 2</td>
<td>Code number 3</td>
<td>Code numbers 4 and 5</td>
</tr>
<tr>
<td>Future Face-to-Face</td>
<td>8</td>
<td>Less preferred</td>
<td>Preferred</td>
<td>More preferred</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Code numbers 1 and 2</td>
<td>Code number 3</td>
<td>Code numbers 4 and 5</td>
</tr>
<tr>
<td>Future Formal</td>
<td>3</td>
<td>Preferred</td>
<td>More preferred</td>
<td></td>
</tr>
<tr>
<td>Future Content</td>
<td>6</td>
<td>More preferred</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Future When</td>
<td>8</td>
<td>Preferred</td>
<td>More preferred</td>
<td></td>
</tr>
<tr>
<td>Future Often</td>
<td>6</td>
<td>More preferred</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Future Long</td>
<td>5</td>
<td>More preferred</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Future Distance

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Future Distance</td>
<td>50 km or less</td>
<td>More than 51 km</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(20) Code number 2</td>
<td>Code numbers 3, 5</td>
<td>Code numbers 6</td>
</tr>
<tr>
<td>Future Dollars</td>
<td>Pay nothing (8)</td>
<td>Pay travel only (15)</td>
<td>Pay money (9)</td>
</tr>
<tr>
<td></td>
<td>Code number 1</td>
<td>Code number 2</td>
<td>Code numbers 3 to 5</td>
</tr>
</tbody>
</table>

8.5.1: Online Professional Development

Most of the online professional development options presented were acceptable to the respondents for online computing PD. Out of the eight online methods for future delivery, at least half of the respondents preferred or more than preferred, the four options of online education department documents, interactive online resources, online exemplars, and YouTube clips. During the interviews, Matthew discussed his use of YouTube short videos on specific ICT concepts to expand his knowledge. A few respondents commented that Online PDs would work better for some teachers.

Table 8.15 shows seven relationships between online options and respondent groups. Females had less preference for both interactive online resources and online forums; whereas males preferred or more preferred interactive sources, and percentage wise equally less preferred (37%) and more preferred online forums (37%). Explanations for these could be due to time factors, the timing of when interactive online resources were scheduled and time to access forums and wait for posting of replies. ICT qualified respondents either preferred or more preferred interactive online resources, however, those not-ICT qualified preferred or less preferred these. This could relate to ICT teachers being more comfortable with
online use. Most respondents aged 31 and over less preferred online exemplar use, while younger respondents preferred or more preferred the use of this material. This may be because older teachers usually have more teaching experience (Section 8.2) and less need for examples. Government school respondents varied in their future preference to the use online exemplars of computer use in other classes. The relationship between school type and online exemplars indicates that government school respondents almost equitably less preferred, preferred, and more preferred them, whereas most non-government respondents less preferred them.

<table>
<thead>
<tr>
<th>Education Department documents</th>
<th>Gender</th>
<th>Qualification</th>
<th>Respondent Age</th>
<th>Teaching Years</th>
<th>Introduced</th>
<th>School Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>.567</td>
<td>.183</td>
<td>.376</td>
<td>.758</td>
<td>.070 (78%)</td>
<td>.859</td>
<td></td>
</tr>
<tr>
<td>Interactive (Webinars) Static documents</td>
<td>.029 (50%)</td>
<td>.075 (50%)</td>
<td>.915</td>
<td>.659</td>
<td>.258</td>
<td>.227</td>
</tr>
<tr>
<td>Static documents</td>
<td>.361</td>
<td>.507</td>
<td>.746</td>
<td>.971</td>
<td>.058 (78%)</td>
<td>.333</td>
</tr>
<tr>
<td>Forums</td>
<td>.092 (67%)</td>
<td>.345</td>
<td>.752</td>
<td>.193</td>
<td>.451</td>
<td>.386</td>
</tr>
<tr>
<td>YouTube</td>
<td>.739</td>
<td>.224</td>
<td>.845</td>
<td>.196</td>
<td>.695</td>
<td>.571</td>
</tr>
<tr>
<td>Webcast / Podcasts</td>
<td>.967</td>
<td>.816</td>
<td>.941</td>
<td>.404</td>
<td>.949</td>
<td>.429</td>
</tr>
<tr>
<td>Video conference</td>
<td>.659</td>
<td>.564</td>
<td>.497</td>
<td>.748</td>
<td>.684</td>
<td>.994</td>
</tr>
<tr>
<td>Exemplars</td>
<td>.972</td>
<td>.758</td>
<td>.076 (50%)</td>
<td>.134</td>
<td>.336</td>
<td>.099 (50%)</td>
</tr>
</tbody>
</table>

Table 8.15: Cross-tabulation of groups and future online variables

Two relationships relate to when respondents first used computers (Table 8.15). Firstly, differences in teachers’ preference for the use of online supplied documents from the education department occurred, teachers who began using computers before secondary school more preferred these documents while those who began use at secondary school less preferred them, and those introduced after
secondary school preferred their use. Secondly, with static online resources, half of those who first accessed computers before secondary school preferred them, all of those introduced at secondary school less preferred them, and 60% of those introduced after secondary school less preferred static online resources. This result suggests that those who first accessed computers at an earlier age may like documental evidence to refer to for clarification.

8.5.2: Face-to-Face Professional Development

The results from Table 7.11 (see Section 7.4.2) indicated that respondents would be reasonably happy with any of the face-to-face options presented for ICT PD. Out of the three most preferred options for face-to-face computing PD, two showed that a relationship existed (Table 8.16). The age range of the respondent reflected their preference for face-to-face PD conducted away from their school. Respondents aged 30 or under more preferred sessions away from their school than the older respondents who less preferred them. An assumption could be made here to suggest that younger teachers would attend PD away from their school for knowledge and network building. When respondents first used computers made a difference to their opinions on conference attendance. Those first introduced to computers before secondary school preferred or less preferred conference attendances and those introduced at secondary school more preferred conferences; however, more of those introduced after secondary school less preferred (55%) conference attendance over more preference (45%).
<table>
<thead>
<tr>
<th>Gender</th>
<th>Qualification</th>
<th>Respondent Age</th>
<th>Teaching Years</th>
<th>Introduced</th>
<th>School Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conference attendance</td>
<td>.567</td>
<td>.105</td>
<td>.474</td>
<td>.372</td>
<td>.001 (78%)</td>
</tr>
<tr>
<td>PD not located at school</td>
<td>.709</td>
<td>.164</td>
<td>.084 (50%)</td>
<td>.273</td>
<td>.251</td>
</tr>
<tr>
<td>PD located at school</td>
<td>.639</td>
<td>.671</td>
<td>.157</td>
<td>.675</td>
<td>.977</td>
</tr>
<tr>
<td>Specific workshop Consultancy presented</td>
<td>.225</td>
<td>.285</td>
<td>.432</td>
<td>.133</td>
<td>.327</td>
</tr>
<tr>
<td>Consultancy presented</td>
<td>.782</td>
<td>.403</td>
<td>.777</td>
<td>.191</td>
<td>.769</td>
</tr>
<tr>
<td>School employee presented</td>
<td>.561</td>
<td>.241</td>
<td>.749</td>
<td>.793</td>
<td>.931</td>
</tr>
<tr>
<td>1 on 1 with school staff</td>
<td>.959</td>
<td>.871</td>
<td>.809</td>
<td>.302</td>
<td>.357</td>
</tr>
<tr>
<td>Family or friends</td>
<td>.866</td>
<td>.315</td>
<td>.726</td>
<td>.907</td>
<td>.726</td>
</tr>
</tbody>
</table>

Table 8.16: Cross-tabulation of groups and future face-to-face methods

8.5.3: Professional Development Formal Courses

Overall, formal certified courses did not rate too highly on respondents list for computing PD. Perhaps this could be due to the time they take, the cost and fitting them in with work commitments and personal life, or possibly their content was not always appropriate. Online accredited courses did rate as the most popular, maybe because respondents could do these when they had the time. Delving into the relationship (Table 8.17) between gender and online accredited courses indicates that all males preferred or more preferred online accredited courses, whereas most females either preferred or less preferred them. Many of the ICT qualified respondents more preferred online accredited courses than those who were not-ICT qualified who preferred or less preferred them. When it came to preferences for accredited courses that you can physically attend, all ICT qualified respondents preferred or more preferred these where non-ICT qualified respondents preferred (36%) or less preferred (40%) them. ICT qualified
respondents equally (43% each) preferred and less preferred accredited distance education courses, while all non-ICT qualified respondents less preferred distance education courses.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Qualification</th>
<th>Respondent Age</th>
<th>Teaching Years</th>
<th>Introduced</th>
<th>School Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Online accredited</td>
<td>.055 (.50%)</td>
<td>.762</td>
<td>.441</td>
<td>.838</td>
<td>.715</td>
</tr>
<tr>
<td>Attended accredited</td>
<td>.804</td>
<td>.039 (.50%)</td>
<td>.762</td>
<td>.913</td>
<td>.969</td>
</tr>
<tr>
<td>Distance education</td>
<td>.192</td>
<td>.000 (67%)</td>
<td>.719</td>
<td>.478</td>
<td>.542</td>
</tr>
</tbody>
</table>

Table 8.17: Cross-tabulation of groups and future formal PD types

8.5.4: Professional Development Content

Respondents were very concerned about learning professional development ICT content relating to their teaching needs, with those of content fit, personal, curricula, and school needs close behind. This section revealed seven relationships with respondent groups (Table 8.18). The first two relationships were with respondents’ age. The relationship between respondent age and content that fits school priorities reveals that younger respondents more preferred this content fit, whereas, older respondents mostly less preferred school content fit. The reverse was true for sessions on a single concept. Respondents 30 and under less preferred single content sessions, while respondents 31 or greater more preferred sessions on a single concept.

The number of years respondents had been teaching showed three relationships in Table 8.18. When it came to content that fit the curricula respondents more preferred this content fit irrespective of their teaching years, however, those that had taught for fewer years preferred this option much greater than those who had taught for more than five years. This could be translated to teachers wishing to meet the curriculum requirements for their students. Most respondents who had taught for under six years less preferred to attend sessions on a single concept but did prefer or more prefer sessions on a broad range of topics. However, the
reverse was true for more experienced teachers who more preferred sessions on a single concept and less preferred a broad range of concepts.

Section 8.2 detailed a close relationship between respondents’ age and years of teaching. The results here could imply that younger teachers may still be building their ICT skill portfolio, where older teachers could be aiming to learn a new skill or update an existing skill.

Two relationships eventuated with school type (Table 8.18). Both types of school respondents more preferred content that fit their teaching needs with government respondents fully preferring this option and three-quarters of non-government respondents more preferring this option, indicating that respondents were dedicated to their profession. Differences in preference to sessions on a single concept and school type occurred. Two-thirds of respondents from government schools less preferred learning single concepts, while at least four-fifths of non-governments school respondents preferred or more preferred PD sessions on a single concept. This could signify that government respondents who were regular users of computing tools (see Section 8.3.1) and fully integrating the teaching of ICT education require a wide range of skills.

<table>
<thead>
<tr>
<th></th>
<th>Gender</th>
<th>Qualification</th>
<th>Respondent Age</th>
<th>Teaching Years</th>
<th>Introduced</th>
<th>School Type</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fit school</strong></td>
<td>.837</td>
<td>.502</td>
<td>.096 (50%)</td>
<td>.587</td>
<td>.984</td>
<td>.344</td>
</tr>
<tr>
<td><strong>Fit curriculum</strong></td>
<td>.565</td>
<td>.406</td>
<td>.215</td>
<td>.049 (67%)</td>
<td>.624</td>
<td>.797</td>
</tr>
<tr>
<td><strong>Fit teachers</strong></td>
<td>.399</td>
<td>.320</td>
<td>.258</td>
<td>1.00</td>
<td>.727</td>
<td>.005 (50%)</td>
</tr>
<tr>
<td><strong>Fit personal</strong></td>
<td>.420</td>
<td>.738</td>
<td>.499</td>
<td>.924</td>
<td>.823</td>
<td>.115</td>
</tr>
<tr>
<td><strong>Single concept</strong></td>
<td>.896</td>
<td>.750</td>
<td>.028 (50%)</td>
<td>.009 (33%)</td>
<td>.983</td>
<td>.022 (67%)</td>
</tr>
<tr>
<td><strong>Broad range of concepts</strong></td>
<td>.164</td>
<td>.604</td>
<td>.793</td>
<td>.031 (33%)</td>
<td>.688</td>
<td>.410</td>
</tr>
</tbody>
</table>

Table 8.18: Cross-tabulation of groups and future PD content
8.5.5: Professional Development Timing

Respondents preferred to undertake computing professional development when they were actually at school, but not in their free teaching periods (see Section 7.4.6) when they would most likely be preparing, planning, or marking. Additionally, respondents were unlikely to attend PD before school, later in the evening, on weekends, or in school holidays. Table 8.19 indicates that five relationships existed between preferences for when computing PD was held and respondent groups. Respondents from neither school type preferred the weekends; all respondents from government schools less preferred weekends for ICT PD attendance, where most respondents from non-government schools less preferred weekends. A similar situation occurred for gender and before school, with females less preferring this time at all, and most males less preferring it.

<table>
<thead>
<tr>
<th></th>
<th>Gender</th>
<th>Qualification</th>
<th>Respondent Age</th>
<th>Teaching Years</th>
<th>Introduced</th>
<th>School Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before school</td>
<td>.085</td>
<td>.060 (50%)</td>
<td>.419</td>
<td>.325</td>
<td>.338</td>
<td>.583</td>
</tr>
<tr>
<td>During school</td>
<td>.275</td>
<td>.520</td>
<td>.523</td>
<td>.452</td>
<td>.786</td>
<td>.809</td>
</tr>
<tr>
<td>Immediately after school</td>
<td>.347</td>
<td>.943</td>
<td>.465</td>
<td>.194</td>
<td>.900</td>
<td>.943</td>
</tr>
<tr>
<td>In the evening</td>
<td>.399</td>
<td>.006 (50%)</td>
<td>.258</td>
<td>1.00</td>
<td>.131</td>
<td>.320</td>
</tr>
<tr>
<td>Free periods</td>
<td>.641</td>
<td>.673</td>
<td>.511</td>
<td>.264</td>
<td>.126</td>
<td>.436</td>
</tr>
<tr>
<td>Student free days</td>
<td>.759</td>
<td>.657</td>
<td>.375</td>
<td>.438</td>
<td>.295</td>
<td>.313</td>
</tr>
<tr>
<td>Weekend</td>
<td>.549</td>
<td>.060 (50%)</td>
<td>.419</td>
<td>.292</td>
<td>.338</td>
<td>.060 (50%)</td>
</tr>
<tr>
<td>School holidays</td>
<td>.167</td>
<td>.133</td>
<td>.690</td>
<td>.211</td>
<td>.327</td>
<td>.556</td>
</tr>
</tbody>
</table>

Table 8.19: Cross-tabulation of groups and future when held

The three remaining relationships in Table 8.19 relate to qualification also showed similar relationships. All of the respondents who were not-ICT qualified less preferred before school, at the weekend, or in the evening, while most of those
who were ICT qualified less preferred any of these options. This section shows that the respondents value work-life balance, with their mornings usually busy preparing for the day ahead, and their evenings and weekends mostly assigned to family, social gatherings, and home life responsibilities.

8.5.6: Professional Development Regularity

Respondents perceived that the more regular computing professional development the better (see Section 7.4.7). At least half of the respondents preferred or more preferred the once during each term and regularly throughout the year options. The two relationships for groups and PD regularity both include once a term (Table 8.20). Male respondents and those who had been teaching for five years or less preferred once a term, whereas, females and those who had taught for greater than five years had less preferred once a term ICT PD sessions. Those respondents with fewer teaching years seem to have a greater need for ICT PD than those with more experience, as explained in 8.5.4. There were no Chi-Square significance results for not at all or only once options, due to all of the combined responses being in the less preferred option.

<table>
<thead>
<tr>
<th></th>
<th>Gender</th>
<th>Qualification</th>
<th>Respondent Age</th>
<th>Teaching Years</th>
<th>Introduced</th>
<th>School Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Once a term</td>
<td>.066</td>
<td>.922</td>
<td>.320</td>
<td>.057 (33%)</td>
<td>.545</td>
<td>.314</td>
</tr>
<tr>
<td>Regular during a term</td>
<td>.483</td>
<td>.612</td>
<td>.117</td>
<td>.319</td>
<td>.386</td>
<td>.572</td>
</tr>
<tr>
<td>Regular during 2 terms</td>
<td>.270</td>
<td>.279</td>
<td>.814</td>
<td>.707</td>
<td>.328</td>
<td>.352</td>
</tr>
<tr>
<td>Regular during the year</td>
<td>.901</td>
<td>.471</td>
<td>.808</td>
<td>1.00</td>
<td>.499</td>
<td>.948</td>
</tr>
</tbody>
</table>

Table 8.20: Cross-tabulation of groups and how often future PD to be held

8.5.7: Professional Development Length

Respondents indicated no high preference for any length of professional
development sessions (see Section 7.4.8). The most acceptable sessions were those over one hour and less than four hours rather than sessions that ran shorter or longer. The two relationships for school type (Table 8.21) both showed neither government nor non-government schools preferred short sessions of less than one hour nor successive days. However, non-government school respondents less preferred these sessions to a greater extent than government school respondents. These relationships suggest that neither school type preferred short sessions, as they may not cover enough detail for respondents and that ICT PD sessions run over successive days might be information overload and arranging a time to attend may be problematic. The gender and full day relationship (Table 8.21) showed that half of the males more preferred a full day PD session, while almost two-thirds of the females less preferred them. Females may have other daily commitments that would restrict their attendance.

<table>
<thead>
<tr>
<th></th>
<th>Gender</th>
<th>Qualification</th>
<th>Respondent Age</th>
<th>Teaching Years</th>
<th>Introduced</th>
<th>School Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1 hour</td>
<td>.602</td>
<td>.910</td>
<td>.111</td>
<td>.121</td>
<td>.314</td>
<td>.058 (67%)</td>
</tr>
<tr>
<td>&lt; 2 hours</td>
<td>.418</td>
<td>.755</td>
<td>.665</td>
<td>.175</td>
<td>.443</td>
<td>.862</td>
</tr>
<tr>
<td>Half day</td>
<td>.123</td>
<td>.559</td>
<td>.150</td>
<td>.133</td>
<td>.674</td>
<td>.559</td>
</tr>
<tr>
<td>Full day</td>
<td>.039 (67%)</td>
<td>.200</td>
<td>.731</td>
<td>.946</td>
<td>.620</td>
<td>.130</td>
</tr>
<tr>
<td>Successive days</td>
<td>.463</td>
<td>.707</td>
<td>.156</td>
<td>.244</td>
<td>.215</td>
<td>.081 (67%)</td>
</tr>
</tbody>
</table>

Table 8.21: Cross-tabulation of groups and future PD length

### 8.5.8: Professional Development Distance and Cost

All the respondents were willing to travel beyond their employed school to access appropriate computing PD, with most being prepared to travel for up to an hour and a half (see Section 7.4.9). However, most respondents preferred to pay as little as possible for these sessions (see Section 7.4.10). These answers were somewhat expected - that their employer should pay for training required for their job. A select few were prepared to travel longer distances, up to 500 kilometres, and contribute up to $200 for the experience. No obvious relationships existed.
between respondent groups and either distance to travel or expenses to pay (Table 8.22).

<table>
<thead>
<tr>
<th></th>
<th>Gender</th>
<th>Qualification</th>
<th>Respondent Age</th>
<th>Teaching Years</th>
<th>Introduced</th>
<th>School Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>PD Travel</td>
<td>1.00</td>
<td>.225</td>
<td>.706</td>
<td>.144</td>
<td>.224</td>
<td>.740</td>
</tr>
<tr>
<td>PD Dollars</td>
<td>.600</td>
<td>.155</td>
<td>.367</td>
<td>.457</td>
<td>.867</td>
<td>.410</td>
</tr>
</tbody>
</table>

Table 8.22: Cross-tabulation of groups and future travelling distance and costs

8.5.9: Groups and Future PD sub-category Relationship Paths

Figure 8.2, the relationship pathways between respondent groups and sub-categories of future PD preferences. Almost half of the future PD sub-category variables did not show any relationships with the six respondent groups, however, this does not mean relationships do not exist between other future PD sub-categories, skills or past PD variables. There was a significant interconnection of group variables between Figures 8.1 and 8.2; however, it was impractical to place them on the one diagram, as this would have been too complicated.
The aim of this chapter was to discuss the questionnaire results and investigate relationships between the survey variables through bivariate analysis. The chapter has shown that many significant relationships exist between variables, and with variables, variable sub-categories, and respondent groups. Most of these relationships crossover each other and interconnect with others, confirming the

---

5 The Key to Figure 8.2
- A green rectangle represents a group variable
- A skin coloured corner cut rectangles represent a Future PD variable sub-category

---

8.6: Summary of Chapter 8

The aim of this chapter was to discuss the questionnaire results and investigate relationships between the survey variables through bivariate analysis. The chapter has shown that many significant relationships exist between variables, and with variables, variable sub-categories, and respondent groups. Most of these relationships crossover each other and interconnect with others, confirming the
complexity of not only ICT but also of the core categories of ICT skills and ICT PD investigated. Those relationships found may require further investigation (see Section 9.7). The next and final chapter will conclude the research.
Chapter 9: Research Outcomes

The preceding chapter discussed the results of the questionnaire and investigated relationships within those results. The purpose of this final chapter is to summarise and conclude the research project. The chapter begins by reviewing the research and using the key findings to answer the research questions, it then presents the Grounded Theory general substantive theory for this project. Next, the chapter presents the research contributions, discusses the limitations of the research, provides recommendations and suggests future research topics. Finally, the chapter discusses partial fulfilment of five research gaps identified by a recently published article.

9.1: Research Review

This research project explained the importance of keeping schoolteachers ICT skills up-to-date. The purpose of the current study was to reveal factors affecting the successfulness of teaching ICT from teachers’ perspectives and to build a theory that encapsulated those perceptions. Commonwealth and State governments have contributed billions of dollars to computing education (see Section 2.3) since its inception and technological advancements now put computing devices in most students’ hands. However, students are not recording higher ICT Literacy scores (see Section 2.4.1), and fewer students are interested in studying computing (see Sections 2.4.2 & 2.4.3). Implications are that students are therefore under-prepared for life in the 21st Century.

Technology development and curriculum changes have integrated computing into most subjects (see Section 2.2) and contributed to an expansion of teachers’ roles (OECD 2005). This meant that almost all teachers are partially responsible for teaching components of computing education. Therefore, they needed to attain, maintain, and regularly improve their computing skills.

This research queried how to improve students’ ICT outcomes and investigating teachers opinions on the matter became the focus; teachers have been shown to be a large influence on student learning.

To investigate the research problem, a Grounded Theory study was undertaken, which included a multi-faceted approach using a variety of paradigms, streams,
purposes, research approaches, data types, sampling procedures, data collection and analysis methods (Chapter 3). Mixed approaches explain the same phenomenon from different viewpoints and assist in providing a holistic outcome.

The project consisted of two successive phases. Phase 1 was exploratory and qualitative; it aimed to understand the phenomenon from the viewpoint of ICT teachers. Purposive selection of interview participants from three different teaching levels occurred - classroom teachers, leading teachers, and heads of departments. The ten interviews, conducted in a semi-structured format, used open-ended questions to collect information of the participants lived experiences. The aim was to discover themes related to the teaching of ICT education (Chapter 4). Analysis consisted of Grounded Theory’s open and selective coding, constant comparison, memos and theoretical sampling. At the conclusion of the analysis, delimitation of data resulted in two core categories (Chapter 5). Literature investigation on the core categories occurred; this assisted in creating questions for the next phase of data collection (Chapter 6).

Phase 2 was descriptive and mainly quantitative; it aimed to verify the core category information and saturate the core categories with sub-categories. The data, collected from 36 respondents, broadened the theoretical sample to include teachers from other subject areas. The second phase used a structured online survey with a combination of open and closed-ended questions. Analysis consisted of Grounded Theory selective and theoretical coding processes and constant comparison (Chapter 7). The variable types collected restricted analysis techniques to statistical descriptive cross-tabulations; these indicated if any relationships existed between the data, and between the data and respondent groups (Chapter 8).

Table 9.1 below outlines the chapters, their research objectives and reviews the content of each chapter.
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Research Objective</th>
<th>Chapter Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Provide details of the research background</td>
<td>Discussed educational influences, the ICT pipeline, research contribution, aims and questions, summarised the research structure, defined the terminology, delimited the boundaries and scope, and presented the research limitations</td>
</tr>
<tr>
<td>2</td>
<td>Investigate the research context</td>
<td>Described an early account of computing in education, presented Victorian curriculums, reviewed recent ICT related policies, investigated student outcomes in ICT, discussed teaching with computers, described the research problem, and re-presented the research questions</td>
</tr>
<tr>
<td>3</td>
<td>Review research methodology, methods and design</td>
<td>Discussed methodological and theoretical grounding, the research aspects involved, population and sampling, grounded theory processes, research phases, ethical issues, generation and verification of grounded theories, provided a grounded theory model for this research, and detailed methodological and design limitations</td>
</tr>
<tr>
<td>4</td>
<td>Investigate ICT interested teachers opinions of ICT education</td>
<td>Phase 1: Presented the data collected from interviews in the six categories of ICT education, ICT education delivery, ICT teachers, ICT teacher support, teaching with ICTs, and student learning with ICTs</td>
</tr>
<tr>
<td>5</td>
<td>Discuss the interview findings and select core categories</td>
<td>Discussed the findings from Phase 1 through education enablers, education inhibitors and school differences, produced a tentative substantive model that tied the findings together and selected core categories for the second phase</td>
</tr>
<tr>
<td>6</td>
<td>Reviewed literature related to the core categories</td>
<td>Reviewed relevant literature on the core categories to assist formation of the survey</td>
</tr>
<tr>
<td>7</td>
<td>Investigate core categories opinions from other teachers</td>
<td>Phase 2: Present data collected from the online questionnaire on the core categories</td>
</tr>
<tr>
<td>8</td>
<td>Discuss the results of the online questionnaire</td>
<td>Discussed findings from Phase 2, and determined where relationships existed</td>
</tr>
<tr>
<td>9</td>
<td>Concluded research project</td>
<td>Reviewed the research project, answered the research questions, developed a general substantive grounded theory, presented research contributions, limitations of research, research recommendations, proposals for future research, and filled some research gaps</td>
</tr>
</tbody>
</table>

Table 9.1: Research Review
9.2: Fulfilling the Research Questions

The research questions consisted of one main question and five sub-questions. Answering the sub-questions first will assist in answering the main question.

9.2.1: Phase 1 Data and Question Answers

The data collected in Phase 1 interviews, presented in Chapter 4 and discussed in Chapter 5, relate to sub-questions 1 and 2.

9.2.1.1: Sub-question 1

Sub-question 1 asks:

_What range of issues do ICT schoolteachers encounter in relation to ICT education?_

- **ICT Education**

ICT teachers enjoyed the flexibility of the compulsory learning years and VET IT course; however, they described the VCE curriculum as outdated and uninspiring. Computing electives for middle secondary year students covered a wide range of topics. However, electives were not that popular and did not fill the gap appropriately between material covered in the compulsory years and the material in VCE. Students were gaining the wrong impressions of VCE IT based on elective or junior secondary years ICT content.

- **ICT Education Delivery**

The loss of core computing classes particularly in public schools placed additional pressures on non-ICT teachers to teach ICT within other discipline areas. Reasons for the discontinuation of the classes were timing, timetabling, an overcrowded curriculum, no ICT teacher available, and that senior classes took precedence to ensure the best possible student outcomes. ICT teachers noted that students were not getting the technical depth of ICT education from non-ICT teachers. ICT teachers became disappointed with the removal of core computing subjects and preferred that they returned and combined with the integrated teaching of ICT education.

ICT teachers did see the benefits of integrated teaching of ICT education, they said that it gave students a view of the usefulness of devices across subjects and they could relate the current concept with real life situations. Furthermore, they
could see the benefits of learning through a different medium and the way that students collaborated with each other. However, concerns existed that the focus was on the other subject and the ICT devices were just a tool for learning.

There was no set way of planning for integrating ICT components. At some schools, individual teachers were wholly responsible for ICT education content, at others, teaching teams were responsible, while at one school an ICT teacher reported that his/her school took a whole school planning approach. Those that planned in teams coordinated their teaching to include ICT concept use.

- **ICT Teachers**
  Two of the ICT teachers interviewed did not possess formal ICT teaching qualifications, and many were the only ICT teacher at their school. The ICT teachers’ pathways into teaching varied, but all had realised their innate technological ability soon after first coming into contact with computers. Some of the ICT teachers contributed significantly to ICT education, their knowledge, personalities and teaching methods improved class numbers, student engagement and interest, and many had the ability to extend their students ICT learning level. Teaching quality is very important, nothing can replace a great teacher, and not even using technology can improve poor teaching, but the use of technology should support teachers and enrich students learning (Schleicher 2012). In Seth's interview, he explained that to improve teacher quality and knowledge, teaching capacity needs improving.

- **ICT Teacher Support**
  Generally, ICT teachers complained about a lack of support from their school, even if the school had technical computer staff available. Technical staff attitudes were often not pleasant; they had to contend with student problems all day long. Teachers would often avoid them when needing help, and alternatively seek out an ICT teacher instead. This sometimes annoyed the ICT teachers with constant interruptions. The situation seemed worse at public schools. The lack of school support spread to ICT PD, public schools were reluctant to pay for external PD for ICT teachers and attendance was limited, and when they had attended, the expectation was that they shared the knowledge on return. More often than not, internal PD sessions did not meet participants’ needs; many ICT teachers delivered sessions at their schools. To improve their own skills, ICT teachers were
resourceful in gaining assistance, with many resorting to self-learning.

- **Teaching with ICTs**
  
  There was a general concern by ICT teachers regarding non-ICT teachers’ low level of ICT knowledge. ICT teachers reported that few teachers were focusing on basic ICT concepts and there seemed to be a lot of reliance on the Microsoft Office package. Non-ICT teachers stayed within their comfort level, which restricted what they taught, and therefore students missed other computing skills. Some non-ICT teachers still feared technology, which affected their confidence and preparedness to incorporate ICT into teaching.

  Computing equipment at the ICT teachers’ schools was unequally distributed, only four schools had achieved 1:1 computer to student access, two were close to this level, and four were not. Use of computer equipment in learning does meet different learning styles, gives hands-on experience, worldly access, and allows students and teachers to view others work.

- **Student Learning with ICTs**
  
  According to the interviewees, younger secondary students were more enthusiastic and interested in ICT studies than middle years or senior students. Younger students were beginning to enter secondary school with a better background of ICT skills; although, in general, students were capable users but did not use technology very creatively. Students possessed varying levels of knowledge, but very few were passionate about ICT. The interviewees said that students lacked fundamental skills and understanding of software components. Students did not seem to be gaining sufficient ICT Literacy skills, their attention was all over the place and they lacked concentration in class; any excuse would suffice not to do school work. Quite a few students took a lazy attitude to learning and expected instantaneity; they relied on what they found and often did not question its authenticity. Students queried why they had to learn this as they thought they already knew it, although, with most students, this was not the case. ICT teachers said that students lacked information, or chose to ignore what they knew on how to protect themselves and their devices while on the Internet. Albeit, benefits did include that students would seek other students out for information, they could alter their work almost instantly, could access schoolwork from anywhere at any time as long as they had a network connection, and were more
likely to do homework if it was on the computer. However, the interviewees did mention that they had to keep a constant eye on students; they could be communicating with anyone anywhere. Senior class sizes had reduced over the years, with some schools no longer offering VCE IT units. Senior students had a large range of choices with three certificate types to choose from, each certificate contains many subjects and courses.

9.2.1.2: Sub-question 2

Sub-question 2 asks:

Which inhibiting core factors affect Victorian ICT schoolteachers abilities in educating their students?

The answer to the first sub-question described the range of issues that ICT teachers experienced. This sub-question delimits the first research phase to one or two core categories. Discussion of the interview findings was under the three lenses of enablers of ICT education, inhibitors of ICT education and school differences of ICT education (Chapter 5). The limiting process looked for the inhibiting factors that mostly affected ICT teachers and the teaching of ICT education. Section 5.2 discussed the inhibiting factors in five areas and Section 5.5 went through the delimiting process.

Revisiting the aim of the research resulted in the removal of all inhibitors that were at the school level or higher (curriculum, equipment, autonomy, staffing, operational factors) and issues from outside of the school (family, home, social, economic). Subsequently, exclusion of student issues discussed by ICT teachers occurred. The remaining focus falls on the inhibiting factors that ICT teachers had divulged.

The findings showed that support for teachers was the biggest inhibiting factor. Teachers of the ICT discipline said that ICT PD provided by their school did not meet their needs and that many non-ICT teachers lacked the skills to teach ICT education, leading to student lack of basic ICT skills. ICT teachers often struggle to source appropriate PD and spend time assisting non-ICT teachers with computing concepts. All teachers need ICT skills in order to teach the required curriculum. The perception from the interviewees was that a skill deficiency was evident in non-ICT teachers.
The delimiting process of the findings of Phase 1 suggests that two major problems underlie support issues and there seem to be two connected issues. First, there was the issue with ICT knowledge and skills not being passed on to students by non-ICT teachers, and second, ICT teachers are complaining about inappropriate ICT PD. Therefore, the core categories chosen as the most inhibiting to Victorian ICT teachers are the skills of non-ICT teachers and appropriate computing PD.

9.2.2: Phase 2 Data and Question Answers

The data collected from the Phase 2 survey, presented in Chapter 7 and discussed in Chapter 8, relates to sub-questions 3, 4 and 5:

- Sub-question 3 relates to the questionnaire’s second section on skills
- Sub-question 4 the third section of past professional development
- Sub-question 5 the fourth section on future professional development.

9.2.2.1: Sub-question 3

Sub-question 3 asks:

*How does the first core factor influence teacher daily activities?*

The first core factor of ‘teachers’ computing skills’ shows that most teachers considered their own computer skill level to be at least intermediate. Most used a computing device at least once a week for teaching in the classroom, less than half taught computing concepts often, and two-thirds thought their skill level sufficient for teaching ICT concepts. According to these results, schools are underutilising their teachers’ abilities in the classroom. Almost three-quarters of teachers indicated that they were prepared for the teaching of Digital Technologies in the Victorian Curriculum, and most reported that students had been using computing devices in the classroom for more than a year. However, this leaves half that does not, or only occasionally, teach computing concepts, a third who considered their skills insufficient to teach concepts, and a quarter not prepared for Digital Technologies.

Even though teachers reported good skill levels, frequent use, and at least moderate preparedness to teach computer concepts, when asked how this affected
the way they taught, they gave varying answers. The majority of the comments were positive; however, there was a considerable amount of comments concerning inhibiting factors; with the number of comments relating to lack of knowledge amounting to the same number as content and confidence together. There were teachers who struggled with teaching ICT concepts to students, which was limited to the extent of their knowledge. To overcome barriers such as these teachers need to improve their ICT skills.

The findings on teachers’ opinions of core computing classes support the case for a return to teaching ICT in schools as a discipline in its own right. Such a change may improve the number of students interested in further ICT studies and strengthen students’ ICT Literacy results.

9.2.2.2: Sub-question 4

Sub-question 4 asks:

*What experiences have schoolteachers encountered in managing the second core factor?*

Responding teachers to the questionnaire indicated that they had not attended enough ICT PD session. More than half indicated that those that they had attended neither met their needs or were at an appropriate level for them. They pointed out that the major barriers to keeping their skills up-to-date and keeping up with technology changes were time, their teaching schedule, opportunity, access, getting the school to pay, school support, skill level, and a lack of personal use of particular applications.

Even though some teachers had received regular PD in the past, over time, their skills became out-dated and they began to struggle with newer concepts. Some teachers who had taught for many years suggested that accessing PD had been an ongoing problem for them, and the more knowledgeable they became the less the PD sessions suited them. Some of the more knowledgeable respondents had presented sessions themselves.

Finding out about professional development was largely up to individual teachers; they relied on their own initiative to search for details and a few requested the creation of a one-stop electronic source on PD. There was little or no school assistance in this matter unless the school was to run a session. Computing PD did
not seem to be high on schools priority lists, planning and offering of sessions were infrequent and often overlooked, which reduced opportunities for teachers to broaden their skills. This coincides with the comments on schools expecting teachers to know things without the school supporting or providing information.

A school’s lack of resources (e.g. time, finances, and technical personal) contributed toward few computing PD sessions on offer. A challenge exists for schools and their governing bodies to provide sufficient quality computing PD sessions for teachers to be adequately skilled in assisting preparing students for a digital economy.

When comparing the comments of respondents who replied re attending a good or a poor computing PD session, Table 9.2 shows almost opposing information between the opinions of the two sessions. There were almost the same number of attributes to a poor PD session as there were for a good PD session, indicating that most respondents had attended at least one of each of these.
<table>
<thead>
<tr>
<th>Good PD Sessions</th>
<th>Poor PD Sessions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relevant content, updated information</td>
<td>Out-dated content, irrelevant to classroom use</td>
</tr>
<tr>
<td>New skills learnt, older skills extended</td>
<td>No new knowledge</td>
</tr>
<tr>
<td>Met their needs and were at an appropriate level</td>
<td>Not a suitable level, too high or too low</td>
</tr>
<tr>
<td>Inspiring and interesting</td>
<td>Uninteresting and uninspiring</td>
</tr>
<tr>
<td>Went at an adequate pace with step-by-step instructions and time for practice</td>
<td>Cramped content, went too fast, no time to practice, not stepped focused</td>
</tr>
<tr>
<td>Presenter knowledgeable and gave clear explanations</td>
<td>Inappropriate presenter, communication problems, made assumptions and/or negative comments about attendees</td>
</tr>
<tr>
<td>Some hand-outs with well-defined explanations</td>
<td>No hand-outs</td>
</tr>
<tr>
<td>Concentrated on a few concepts related to one topic, software familiarisation, clear examples</td>
<td>Limited focus, went off topic, superficial or too technical</td>
</tr>
<tr>
<td>Classroom applicability described</td>
<td>Minimum discussion on applicability and capability</td>
</tr>
<tr>
<td>Collaboration with attendees</td>
<td>Equipment not in use at school</td>
</tr>
<tr>
<td></td>
<td>Timing wrong to align with school needs</td>
</tr>
<tr>
<td></td>
<td>Advertised as one thing but presented as a sales pitch – time waster</td>
</tr>
</tbody>
</table>

Table 9.2: Attributes of good and poor PD sessions

Governmental and other sources have provided funding through multiple programs for teachers to undertake training and PD to enhance their ICT knowledge and skills (see Section 2.3), although these programs were limited in their time and funding allocation, and were not continuous. Apparently, neither interview participants nor questionnaire respondents knew of such resources. This would indicate that the current system does not seem to be working effectively.

9.2.2.3: Sub-question 5

Sub-question 5 asks:

*How do schoolteachers think they can improve their situation in the future in relation to these core factors?*

Survey respondents indicated that a mixture of computing professional development online and/or face-to-face delivery methods would suit most
teachers. Few teachers would undertake formal accredited courses, possibly due to time, cost, and a loss of earnings while doing the course. All content fit types suggested were acceptable, however, some rated more strongly than others did, and the general preference was to learn more than a single concept at a time. Teachers were willing to attend ICT PD as long as it did not interfere with their class preparation and teaching requirements and was not too far outside of their usual working hours. The respondents’ definitely preferred regular computing PD sessions that did not require too much travelling or expense. Some respondents asked for ICT PD sessions on basic content, while others requested advanced techniques. One respondent commented that there was a huge need for time release for individuals to meet ICT PD needs.

Collectively, the tables in Section 7.4 show that there are a few strong preferences for some particular forms of ICT PD delivery; however, there was no particular standout form (also a respondent comment) of completeness to meet the needs of all teachers. In another word, ‘one size does not fit all’, confirming Schleicher (2012), Aston 1988, and Mueller's et al. 2008 concluded that there no single best method existed (see Section 6.2.4.3). Meeting the needs of teachers for ICT PD is an individual’s choice and a variety of options need to be available. This conclusion makes it even more difficult to meet the computing PD needs of teachers.

9.2.3: The Overarching Research Question

The main research question is:

*How can teachers improve the factors affecting the successful teaching of ICT in schools?*

The findings suggest that in general ICT education has a complex nature. ‘The Tangled Web of ICT Education’ showed numerous factors that impact upon teachers and the teaching of ICT in schools. The research showed little difference in opinions of ICT and non-ICT teachers, with non-ICT teachers supporting the comments raised by ICT teachers in relation to their ICT skills and ICT PD needs.

One of the most significant findings to emerge from this study was that most computing professional development does not meet either ICT or non-ICT teachers’ needs, a changing teaching environment does nothing to assist this, and
many schools fail to include ICT PD in their planning. The second major finding was that a third of non-ICT teachers who responded considered their computing skills level inadequate to teach computing concepts in the classroom. Additionally, students lacked basic skills and had the attitude that computers were just a part of life and why should they learn about them.

The circularity between these two major findings indicate a ‘chicken and egg’ situation; is the skills shortage due to lack of appropriate ICT PD, or the other way round?

The project concluded that there are teachers who still lack basic computing skills, and teachers are unable to access appropriate ICT PD. No single type of ICT PD meets all teachers’ ICT needs, and, although the government provides support for ICT and ICT in education, it does not reach those that need it most.

During the course of this research, some action had begun to deal with the problems identified. In the latest round of Australian government educational initiatives, the $112.2 million National Innovation and Science Agenda commenced mid-2016 (Australian Government & DET n.d.). The aim of the agenda is to inspire all Australians in Digital Literacy and Science, Technology, Engineering and Mathematics (STEM) (Australian Government & DET n.d.). Part of the agenda includes an online course for teachers of Foundation to Year 8 to upskill their Digital Technology competencies (Australian Government & DET n.d.). The national initiative includes travelling specialist ICT teachers to attend schools to train teachers and provide in-class support (Australian Government 2016). In Victoria, allocation of $21.6 million for teacher professional development to incorporate the Victorian Curriculum includes PD for STEM and digital coding (State Government of Victoria 2015). Additionally, 60 teachers from 30 Victorian disadvantaged secondary schools are undergoing two years of Post-Graduate training ‘to become STEM “catalysts”’ and mentors for teachers of Years 7 and 8 (State Government of Victoria 2015, p. 14); with course fees are paid by the Department of Education and Training (Moss 2016). As this research demonstrates, these actions are certainly required, but with Jacks (2017), suggesting that currently, only one teacher in three was qualified to teach the new compulsory computing subjects, the question remains whether this was enough.


9.3: Theory Presentation

According to Glaser and Strauss (1967), a theory should describe and explain a theme in a way that was abstract enough to change over time. Moving from a substantive theory to a general substantive theory includes partial abstraction and generalisability, however, not to the extent of abstraction a formal theory requires.

Previously, this research has shown the complexity of ICT and ICT education, it concentrated on the two core categories of teachers’ computing skills and teachers’ involvement in computing PD. Chapter 8 described the significant relationships discovered through the second research phase; it also diagrammatically presented the relationship paths (Figures 8.1 & 8.2). Combining these results with information gathered through the interviews from Phase 1 (Chapters 4 & 5), resulted in Figure 9.1 of categories and their observed relationships. The figure, Figure 9.1, includes two incidences of teaching ICT concepts within teachers’ computing skills; teachers computing skills are central to both the teaching of ICT concepts and the regularity of their teaching.

Figure 9.1: Research categories and their relationships
Presentation of the theory is in respect to the contributions of this research. This research has shown that the issues applicable to ICT teachers were also applicable to teachers of many other subject areas, as they were also required to use ICT tools and teach ICT concepts. The core categories, sub-categories, and minor categories revealed in this research (Figures 5.1 & 9.1) form the base for developing a grounded general substantive theory for teachers’ ICT skill development (Figure 9.2). The theory condenses the research project in a somewhat abstract form that is applicable to schoolteachers at primary and secondary school levels; however, only further research will tell if it is applicable to other levels of education.

![Diagram](image)

Figure 9.2: General substantive theory for teachers’ ICT skill development

### 9.4: Research Contributions

The current findings add to a growing body of literature on the use of Grounded Theory research and contribute to the fields of computing and education. The research expands existing knowledge to include ICT teachers’ opinions of ICT
education, teachers’ perspectives of the successfullness of ICT education, teachers’ opinions of their own computing skills, teachers’ experiences in computing PD, and teachers’ wishes for future PD involvement. Moreover, it verifies students’ low interest in ICT study.

The research extends Grounded Theory research using multiple mixed methods. The research, based on a mixture of underlying components, incorporates most of the grounded theory aspects from the Glaserian strand and contributes to the production of a tentative substantive model and a general substantive theory.

Furthermore, the research informs professional development providers, educational authorities, teacher training institutions, schools, and teachers on ways to improve teachers’ involvement in ICT education. The resulting research information may complement future research projects, to appropriately provide and present computing PD to teachers, to assist teachers in preparing for and teaching ICT education. Additionally, the knowledge gained and theory developed could translate to other school subject areas.

9.5: Limitations of Research

Initial research based limitations were discussed in Section 1.7 and methodological and design limitations in Section 3.10. Consideration of a number of additional limitations that became apparent during the research is below.

After conducting about half of the study and having major problems in connecting a relevant theory base, Grounded Theory came to the researcher’s attention and upon investigation, it was realised that the project had actually been following most of the Grounded Theory processes. A steep learning curve to familiarise and learn about Grounded Theory and its processes followed, then, the selection of the Glaserian version occurred as it closely fitted the project. During the course of the project, the focus periodically altered to fit the data collected and the Grounded Theory process. Even though the placement of the first literature review was early in the thesis, Chapter 2, formation occurred throughout the first phase of research with the successes and failures of policies and initiatives added as they came apparent. Although this is not the usual procedure for a literature review, delaying and elongating the literature review is a common practice in Grounded Theory investigations (Fernández 2004; Glaser & Strauss 1967; Urquhart 2013). ‘In
Other associated problems with Grounded Theory were the limitation of forming a formal theory; the researcher’s abstraction abilities are not yet fully developed, and together with low generalisability of data, the research was limited to a general substantive theory.

This was not the first research project to undergo structural problems with conducting Grounded Theory. Wiesche et al. (2017) revealed that inexperience with or a lack of understanding of Grounded Theory processes caused some authors to use limited procedures. While Fernández (2004) describes that Grounded Theory researchers often do not understand the methods. Wiesche et al. (2017) further explained that even though Grounded Theorists described procedure processes, they did not indicate precisely how to perform the procedures and an element of guesswork was required when conducting the analysis.

Sampling processes performed may have somewhat restricted participants. The research could have benefited from randomly selected teachers from other educational institutions such as pre-schools, primary schools, or post-secondary providers or from other states and territories within Australia. Failure of the Australian Teacher Magazine advertisement to elicit a large number of questionnaire respondents occurred, even though the publishers had given the researcher a huge pitch on its distribution breadth and numbers.

The questionnaire should have included an additional question attached to Question 10 on whether respondents’ computer skill influenced the teaching of computing concepts. During analysis, it was realised that there was no distinction between a positive and a negative impact. The current study was unable to further cross-analyse the data collected about future PD variables. Performing this analysis and writing it up would have taken more time and space than what was possible for research.

Data collection occurred during a time of great change. There had been a recent curriculum change and the implementation of the Victorian Curriculum was not far away, this caused upheaval with keeping up for schools and teachers. Computer learning was becoming ubiquitous, and during the course of the
interviews, computer access for students was increasing while core computer classes were decreasing. The Digital Education Revolution (DER) was in its final year and its initiatives may not have been applied for by all schools, and for those that had applied, these may not have had received their requested allocation of computers and therefore the full impact on schools and teachers would be unknown. Additionally, the DER was making changes to teacher training to incorporate Digital Technologies in the new curriculum (see Section 2.3.1.2); however, as it takes three to four years to complete teacher training, any benefit of this training will eventuate after the completion of this research. This research has shown that the DER NSSCF component may have had an influence on older students and computer access; however, it does not seem that any teachers participating in this research had accessed any of the funding set aside for teachers’ PD.

Despite the number of research limitations, the research project met its overall objectives.

9.6: Research Recommendations

The current generation of secondary school students do not meet acceptable ICT Literacy standards and have little interest in continuing to study ICT. Changes need to happen; the current system does not meet the needs of either teachers or students, therefore, effective ICT development is essential for all. This research has thrown up many questions in need of further investigation. The following recommendations are provided at five different levels, although some of the suggestions may be applicable to more than one level.

9.6.1: Professional Development Provider Level

Recommendations for professional development providers are irrespective of where or who conducts the sessions. Professional development providers should ensure that they offer appropriately informed sessions, with the sessions meeting the needs of the participants, the levels of students the participants taught, and aimed at differing teacher ICT knowledge levels to cater for teachers of varying computer experience. Providers should appropriately publicise the content and notify the potential participants of the sessions expected details and plan of implementation. Providers should also employ a suitable person to implement the
session effectively as advertised, who can also answer any queries that arise.

When planning the PD activity providers should not overcrowd it and allow sufficient time for teaching and listening, application, practice and consolidation. Sessions with larger and more difficult tasks could be broken into smaller and simpler steps to build slowly toward the larger task. Additionally, they could prepare appropriate follow-up activities; provide future contact details, and keep the sessions as cost effective as possible.

The content of the PD sessions offered should align with the curriculum and school expectations, with the aim of improving or refreshing teachers’ skills to meet those expectations. There should be sessions that cover basic, intermediate or advanced topics such as those mentioned in this research that included the use and understanding of software, terminology, latest applications, platform differences, and skill transferability.

**9.6.2: Educational Authorities Level**

It is very difficult for a single researcher to influence changes to government policies but the hope is that they learn from past successes and mistakes to improve student outcomes in the future. Public schools could benefit from more support, particularly those in regional and low socio-economic regions. Increasing funding to public schools for ICT PD and ensuring that all schools have available and easy access to a suitably qualified person for when assistance was required.

A few participants and respondents requested that educational authorities supplied a one-stop portal for PD activities. This could include structured courses, other schools PD plans, links to providers outside of the educational authorities, and other training opportunities. The portal could also indicate where the content links to the national curriculum in Victoria. In addition to the portal, the educational authorities could include a stipulation that each year teachers undertake some computing PD, similar to the requirement for teaching learners with special needs (VIT 2015).

Educational authorities could review the ICT curriculum more regularly; it needs to be up-to-date with technological and social changes. The hope is that the Victorian Curriculum Digital Technologies strand and subjects deliver a continuous flow of ICT curriculum from the youngest student to the oldest and
that it includes higher-order thinking skills such as those mentioned by some interviewees.

9.6.3: Teacher Training Level

This research recommends that providers of teacher training courses keep content as up-to-date as possible with both technology and the curriculum. Pre-service teachers, regardless of their chosen discipline, need to enter the workforce with sufficient ICT skills and knowledge to teach ICT concepts. They need to know the most up-to-date and latest in technical content and made aware of the necessity of incorporating ICT within all disciplines as they would with the English language.

9.6.4: School and School Governance Levels

Recommendations for schools cover the topics of collaboration, access to support, planning, assessing, and content. Schools could collaborate with neighbouring schools and educational facilities to make the best use of computer knowledgeable staff to conduct PD sessions. Schools could coordinate their student free days and run various PD sessions via face-to-face or electronic means. Multiple sessions could run concurrently on the same day with each aimed at different student and teacher levels or concepts to cater for a wide range of teachers. Teachers could select those most appropriate sessions to meet their needs. Additionally, sessions could include areas other than computing.

Where a school has more than one staff member with advanced computer skills, they could assign them as a formal part of their load duty on particular days or times for availability to assist others with ICT issues. Providing access to support in this way reduces the pressure on any particular one person and teachers know where and when to go and who to ask for help. This might require a reconceptualising and recalculation of teacher staffing levels for schools.

Schools need to prioritise support for those teachers who seek appropriate ICT PD pursuits outside of the school. They could also increase teacher support for use of ICT tools in the classroom through assisting teachers to increase their computing knowledge through PD, other training sessions, individual assistance, or by inviting computer knowledgeable community members to provide information for teachers or to assist teachers in the classroom.
Skills and knowledge of teachers teaching with ICTs need to be continually improved and hence this needs an ongoing budget line to enable sufficient resources. Computing requires regular PD more than many other educational areas. The dynamic nature of ICT needs more frequent PD than it would for a more static subject such as those in the humanities area. Schools should be encouraged to make full use of their student free days to incorporate short ICT focused sessions. Schools should increase opportunities for ICT PD for their teachers when preparing their yearly plan and allocate appropriate time and costs for ICT PD. Planning should include determining whether all teachers have a clear understanding of the schools ICT objectives, how to achieve the school’s ICT objectives, and what training needs implementing to develop the plan.

Part of the planning process could be to use a whole school approach and include teachers self-evaluating their ICT skills against a checklist of the schools’ impending requirements, the curriculum, and teachers’ professional standards for computing. The checklist could be similar to the learning technologies teacher capabilities questionnaire used to project PD requirements (Department of Education 1999; Leigh 2000). This would identify teachers’ current strengths and weaknesses, and with the strengths harnessed and the weaknesses built upon teachers ICT skills would improve. Additionally, it would highlight needed ICT PD areas.

Schools should continue to encourage teachers who have attended external ICT PD to share their knowledge. Additionally, schools should make sure that content presented at internal ICT PD was reflective of what students were expected to learn in their classrooms and that teachers continued to develop their ICT skills. Some suggestions from this research for school computing PD are learning sessions on usable programs, varying the topics of each session to broaden teachers’ knowledge, the use of programs that encourage different learning techniques and thinking levels, and the functions of the school, teacher and student devices.

This research recommends that schools consider re-introducing core computing classes. They should also endeavour to keep improving teachers’ computer skills and knowledge by providing appropriate computing PD and access to assistance as needed.
9.6.5: Teacher Level

At the teacher level, this research recommends that teachers take initiative to seek out appropriate ICT training opportunities in a multiple of ways. Firstly, they should investigate what skills the school wants the students to have and incorporate those into their teaching practice. If they do not possess or are not confident with any of those skills, they should notify the school of their impending ICT needs. Teachers need to select carefully their computing PD and its content. Teachers should make full use of their study leave options to attend ICT PD and encourage their principle to approve their application for the betterment of the whole school (DET 2016b). They also should try to structure time for learning and practising new computing skills and make sure that prior to implementing them into the classroom they are familiar with them. Seeking help from other school employees is a further way to obtain information, and if they are able to they should share their knowledge with others. Finally, if teachers could encourage more student collaboration in their classes to make full use of the students’ knowledge bank in ICT.

9.7: Proposals for Future Research

This Grounded Theory research project has shown there are multiple factors affecting the successfulness of teaching ICT in Victorian schools. The complexity of the subject and its sub-areas were too large to investigate within a single research project, therefore opening up opportunities for future research. Further study of the selected categories could consolidate, test and verify the relationship findings and the developed theory, or otherwise, they may refute them. Additionally, further investigation of other sectors and sub-sectors could develop and strengthen the theory in different directions. Any of the categories investigated in a deeper context could reveal underlying enhancing and inhibiting factors to the learning process. The opportunity remains for the theory to become a formal theory through further abstraction and application to other areas of learning.

Subsequent studies in this field could use a larger sample of participants possibly obtained through different data collection strategies and include those from preschool or post-secondary educational sectors, or from different Australian states.
and territories. These could focus more on primary teachers, as they were the least represented in this project. When quantitative data is collected it should include other measurement levels to widen the statistical processes available for analysis.

Forthcoming studies into computing professional development could include how schools (and teachers) decide upon, plan for, and derive topics and content for internally run sessions. Additionally, they could look into how schools can increase opportunities for ICT PD. Other research opportunities could include comparing the publicised material of external computing PD sessions with the expectations of attendees and then with their participation experiences. Other PD topics to be investigated could be how do teachers find out about ICT PD sessions, is there a difference in the quality of external to internal computing PD, and what have the recent initiatives done for ICT PD (see Section 2.3).

Furthermore, research on what sorts of activities bring teachers more confidence with using computers, and how to support them to build their confidence would be useful. There may also be the opportunity to look into utilising newly qualified teachers who trained under the TTF initiative (see Section 2.3.1.2) to become ICT PD presenters of their attained up-to-date skills.

Final future research suggestions relate to the Victorian Curriculum and the Digital Technologies curriculum. Topics worthy of follow-up in a few years’ time could be:

- how have schools implemented Digital Technology Education
- how have teachers adjusted to the new requirements of Digital Technology Education
- how have teachers increased their ICT skills since the introduction of Digital Technologies
- teachers more confident to teach Digital Technologies or does the problem of teachers’ lack of skills to teach computing concepts still exist.

9.8: Filling Some Newly Identified Gaps

Recent research conducted by Pérez-Sanagustín et al. (2017) focused on systematically reviewing educational technology papers published in the *Computers and Education Journal* between January 2011 and December 2015.
Their selection criteria resulted in over 350 journal articles and they concluded their paper by identifying eight key research gaps. This research crosses the boundaries and partially contributes towards five of those gaps.

Pérez-Sanagustín et al. (2017) requested more studies on teachers’ perspectives, embedment of computers in the curriculum, and teachers’ computer teaching practices. Most of the articles were student-centred with only 21% of the studies focusing on teachers and a further 9% including teachers as part of their participants. This research’s whole focus was on teachers and their perceptions of teaching with ICT and the issues that affected it.

Pérez-Sanagustín et al. (2017) mentioned a gap in approaches; 50% of the articles studied used a quantitative approach, 34% a mixed approach and 16% a qualitative approach. Although this project was overall a mixed approach, one phase was qualitative, while the other, mixed.

A third gap called for more research in specific disciplines, the assessment of important educational computing skills, and schools accountability for teaching those skills (Pérez-Sanagustín et al. 2017). This research has shown it is not always the school that should be accountable, sometimes the responsibility passes on to the teachers, and then the teaching of ICT skills depends on their knowledge and skillset to teach them.

A further gap related to understanding the educational use of technology at the school level in countries other than Asia, Western Europe and North America, which were the dominant countries represented (Pérez-Sanagustín et al. 2017). The least two represented regions were Africa at 1%, and Oceania at 4% of the articles. The nations of Australia, New Zealand, and Papua New Guinea, and the island groups of Polynesia, Micronesia, and Melanesia make up Oceania (Reader’s Digest 2010); therefore, this project introduces an Australian perspective of the educational use of technology at the school level.

The final gap this research contributes to is the daily problems experienced by teachers and students according to technological solutions and that these may be due to limited key stakeholder involvement (Pérez-Sanagustín et al. 2017). A school's key stakeholders include the school’s administrative leaders, parents, the wider community and the schools governing bodies. The autonomy given to
schools in Australia seems to have moved some of the responsibilities from the government onto public schools. This project highlighted that some school stakeholders have not sufficiently dealt with some daily problems teachers and students face in relation to computing education.
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## Appendix A: Timeline of Victorian Curriculums, and Victorian and Australian Policies and Initiatives

<table>
<thead>
<tr>
<th>Year</th>
<th>Compulsory Years Curriculum</th>
<th>ICT in Compulsory Years</th>
<th>Post-Compulsory Years Curriculum</th>
<th>IT in Post-Compulsory Years</th>
<th>Victorian Initiatives and Policies</th>
<th>National Initiatives and Policies</th>
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<tbody>
<tr>
<td>1978 - 1979</td>
<td></td>
<td></td>
<td></td>
<td>Computer Travelling Roadshow</td>
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<tr>
<td>1980</td>
<td></td>
<td>Computer Awareness suggested for years 9 and 10</td>
<td></td>
<td>Victorian Secondary Computer Education Committee formed</td>
<td></td>
<td>State Computer Education Centres set up</td>
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<tr>
<td>1981</td>
<td></td>
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<td>1981-1990 HSC IT studies (Table C.1)</td>
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<tr>
<td>1983</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Commonwealth Schools Commission guidelines for computing education</td>
<td></td>
</tr>
<tr>
<td>1984</td>
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<td></td>
<td></td>
<td></td>
<td>National Computer Education Program National Computers in Schools Program</td>
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</tr>
<tr>
<td>1985</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ministerial Review of Postcompulsory Schooling VCE report</td>
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</tr>
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<td>1986</td>
<td>Curriculum Frameworks P-12, Keyboarding &amp; Information Processing in Commerce</td>
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<td></td>
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<td></td>
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<tr>
<td>1987</td>
<td></td>
<td>VCE introduced for Year 12</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Year</td>
<td>Description</td>
<td>1991-1993 VCE IT Study Design (Table C.1)</td>
<td>1995-1997 VCE IT Study Design (Table C.1)</td>
<td>2000-2002 VCE IT Study Design (Table C.1)</td>
<td>2003-2006 VCE IT study design (Table C.1)</td>
<td>VicSmart began</td>
</tr>
<tr>
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<td>----------------------------------------</td>
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<td>----------------------------------------</td>
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<tr>
<td>1988</td>
<td>The School Curriculum and Organisation Framework</td>
<td>IS in Commerce, keyboarding and CS possible to integrate into Mathematics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1990</td>
<td></td>
<td>2 year VCE program for Years 11 and 12</td>
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<td></td>
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</tr>
<tr>
<td>1993</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>VET introduced</td>
</tr>
<tr>
<td>1994</td>
<td></td>
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<td></td>
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<td></td>
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</tr>
<tr>
<td>1995</td>
<td>CSF</td>
<td>IT and Computing in Technology Option to integrate Technology</td>
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<tr>
<td>1997</td>
<td></td>
<td>VET within VCE</td>
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<td>Computer Technologies for Schools project</td>
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<td></td>
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<td>2000</td>
<td>CSF II</td>
<td>Option to embed ICT into all learning areas PISA study</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td></td>
<td>PISA study</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td></td>
<td>VCAL introduced</td>
<td></td>
<td></td>
<td></td>
<td>NAP – ICTL testing</td>
</tr>
<tr>
<td>Year</td>
<td>Program/Initiative</td>
<td>Description</td>
<td></td>
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<td></td>
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<tr>
<td>2006</td>
<td>VELS</td>
<td>ICT in the Interdisciplinary Learning strand PISA study</td>
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<tr>
<td>2007</td>
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<td>2007-2010 VCE IT study design (Table C.1)</td>
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<tr>
<td>2008</td>
<td>NAP – ICTL testing</td>
<td>ICT: Start here Go Anywhere campaign began in QLD</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>2009</td>
<td>PISA study</td>
<td>BER and DER funding began</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>ICT: Start here Go Anywhere campaign went national</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2010</td>
<td></td>
<td>Netbook Project began</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>OLPC began in Australia</td>
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<tr>
<td>2011</td>
<td>NAP – ICTL testing</td>
<td>2011-2014 VCE IT study design (Table C.1)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>PISA study</td>
<td>Netbook Project ended</td>
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<tr>
<td></td>
<td></td>
<td>VicSmart ended</td>
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<tr>
<td>2013</td>
<td>AusVELS ICILS</td>
<td>School leaving age increased to 17 nationally</td>
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<tr>
<td></td>
<td>study</td>
<td>NBN rollout began</td>
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<td>2014</td>
<td>NAP – ICTL testing</td>
<td>Ultranet ended</td>
<td></td>
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<td></td>
<td></td>
<td>DER funding ended</td>
<td></td>
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<tr>
<td>2016</td>
<td>The Victorian</td>
<td>Transition began to senior studies in the Australian Curriculum</td>
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<td></td>
<td>Curriculum F-10</td>
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<tr>
<td></td>
<td>ICT General</td>
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<td>Capabilities,</td>
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<tr>
<td></td>
<td>Digital Technologies strand and subject</td>
<td></td>
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</tbody>
</table>

Table A: Timeline of Victorian Curriculums, and Victorian and Australian Policies and Initiatives
Appendix B: Compulsory Learning Years Curriculums


The 1987 ‘Curriculum Framework’ detailed nine broad study areas consisting of The Arts, Commerce, English, Languages other than English (LOTE), Mathematics, Personal Development, Practical Studies and Design, Science, and Social Education (Curriculum Branch 1985). Additionally, the Curriculum Framework included a general statement on school organisation and curriculum (Curriculum Branch 1985). The design of the Curriculum Framework was for students in all year levels from P to 12 and became known as the Framework (Curriculum Branch 1985).

The Commerce area covered the educational areas of Keyboarding, Information Processing, Employment, Finance, Economics, Legal, Consumerism, and Business (Curriculum Branch 1985). The framework detailed that students would use applications such as word processors, spreadsheets, and databases (Curriculum Branch 1985). Computer studies were additionally included into Mathematics and Science. In Mathematical Studies, one of the guiding principles was ‘the use of calculators and computers throughout the P-12 Mathematics curriculum’ (Curriculum Branch 1985, p. 32). In the Science study area, Technology, Science, and societal issues combined so that students could gain and apply knowledge in a social context (Curriculum Branch 1985).

In 1988, the release of an updated version ‘The School Curriculum and Organisation Framework’ for years P – 12 occurred with the study areas of The Arts, Commerce, English Language, LOTE, Mathematics, Personal Development, Science, Social Education, and Technology Studies (Curriculum Branch 1988). This framework included a statement on values and beliefs in relation to school organisation, school policies, student services, and teaching programs (Figure B.1) (Curriculum Branch 1988, pp. 6-7).

The release of the School Curriculum and Organisation Framework in 1988 detailed the influence of Information Systems as a focus of Commerce, with Keyboarding and Computer Science outlined as possible integrated programs for Mathematics, and computer software listed as a support material for all learning areas (Curriculum Branch 1988). The Practical Studies and Design learning area
from the previous Curriculum Framework was rebranded as Technology Studies, focusing on the use of tools and machines, investigating how and why things worked, constructing with materials, gaining skills through formal instruction and inquiry methods, and examples listed as electronics, materials, graphics, draft and design, vehicle operation and transport (Curriculum Branch 1988).

Figure B.1: The structure of Curriculum Frameworks (Curriculum Branch 1988, pp. 6-7)
Appendix B.2: Curriculum and Standards Frameworks, 1995 - 2005

The Curriculum and Standards Framework (CSF), for years P-10 was organised into the eight KLA’s of The Arts, English, Health and Physical Education, LOTE, Mathematics, Science, Studies of Society and the Environment, and Technology (Board of Studies 1995a). Each KLA was sub-divided into strands, and provided for student achievement and reporting over seven levels (Table B.1). When planning the CSF a decision was to include unique developmental levels for reporting student performances rather than reporting against their school year, and in the process making reporting an individual child a centric action (Yates & Collins 2008).

The technology area included three strands and four phases. The strands were Information, Materials, and Systems; and the phases, investigating, designing, producing and evaluating; each included at all learning levels (Board of Studies 1995b). The term Technology referred to ‘equipment and processes people use to enhance, maintain, manipulate and modify the environment and resources to support the human endeavour. Technology involves the purposeful application of knowledge, skills, equipment, materials and information to create useful products’ (Board of Studies 1995b, p. 9). The CSF technology area included studies in areas such as food production, transport, processing, management, entertainment, manufacturing, mechanical, electrical, electronic, wood, metal, pottery, textiles, plastic, computers, and machinery (Board of Studies 1995b).

The CSFII introduced six new elements into the curriculum and continued the same KLAs, although now were reported over six levels (Table B.1) (Board of Studies 2000a). CSFII Technology now involved ‘the purposeful application of knowledge, skills, equipment, materials, energy and data to create useful products’ (Board of Studies 2000b). There was a change in the focus of strands and their inclusion at learning levels. The Information strand was to be present at all levels, Materials were essential for levels 1 to 3, and either Systems or Materials at levels 4-6 (Board of Studies 2000b).
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<tr>
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<th></th>
</tr>
</thead>
<tbody>
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<td>Preparatory/ Foundation (5 - 6)</td>
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<td>1</td>
<td>Foundation</td>
<td>Foundation</td>
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<tr>
<td>1 (6 - 7)</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2 (7 - 8)</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
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<tr>
<td>3 (8 - 9)</td>
<td>4</td>
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<td>5</td>
<td>5</td>
</tr>
<tr>
<td>4 (9 - 10)</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>7</td>
<td>7</td>
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<td>5 (10 – 11)</td>
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<td>9</td>
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</tr>
<tr>
<td>6 (11 – 12)</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>10, 10A</td>
<td>10, 10A (extension of 10)</td>
</tr>
<tr>
<td>7 (12 – 13)</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>10, 10A</td>
<td>10, 10A (extension of 10)</td>
</tr>
<tr>
<td>8 (13 – 14)</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 (14 – 15)</td>
<td>10 (15 – 16)</td>
<td></td>
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</tbody>
</table>

Table B.1: Summary of curriculum framework levels for compulsory learning years
Appendix B.3: Victorian Essential Learning Standards 2006-2012

The VELS structure for students in years P-10 included three equal intertwined strands in a cross-curricular perspective (Figure B.2) (VCAA 2007, p. 6) with student assessment and reporting occurred over six learning levels (Table B.1). Each strand consisted of several domains and their related dimensions (Figure B.3) (VCAA 2007, p. 7), with each domain containing achievable learning statements (VCAA 2007). VELS Domains had progressively been revised, updated, redeveloped and reaccredited during its years in use setting state-wide standards in education (VCAA 2007; n.d.c).
The ICT Domain was within the Interdisciplinary Strand. The ICT domain had three dimensions that were ICT for visual thinking, ICT for creating, and ICT for communicating, each with learning statements and professional elaborations for
the end of years 3, 5, 7, and 9 (Table B.1) (Curriculum Corporation 2006; VCAA 2007; 2008).

<table>
<thead>
<tr>
<th>Strand</th>
<th>Domain</th>
<th>Dimension</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical, Personal and Social Learning</td>
<td>Health and Physical Education</td>
<td>Movement and physical activity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Health knowledge and promotion</td>
</tr>
<tr>
<td>Interpersonal Development</td>
<td>Building social relationships</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Working in teams</td>
<td></td>
</tr>
<tr>
<td>Personal Learning</td>
<td>The individual learner</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Managing personal learning</td>
<td></td>
</tr>
<tr>
<td>Civics and Citizenship</td>
<td>Civic knowledge and understanding</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Community engagement</td>
<td></td>
</tr>
<tr>
<td>Discipline-based Learning</td>
<td>The Arts</td>
<td>Creating and making</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Exploring and responding</td>
</tr>
<tr>
<td>English</td>
<td>Reading</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Writing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Speaking and listening</td>
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</tr>
<tr>
<td>Languages Other Than English</td>
<td>Communicating in a language other than English</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Intercultural knowledge and language awareness</td>
<td></td>
</tr>
<tr>
<td>The Humanities</td>
<td>Economics</td>
<td>Economic knowledge and understanding</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Economic reasoning and interpretation</td>
</tr>
<tr>
<td>Geography</td>
<td>Geographical knowledge and understanding</td>
<td></td>
</tr>
<tr>
<td>History</td>
<td>Historical knowledge and understanding</td>
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<td></td>
<td>Historical reasoning and interpretation</td>
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<td>Mathematics</td>
<td>Number</td>
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</tr>
<tr>
<td></td>
<td>Space</td>
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</tr>
<tr>
<td></td>
<td>Measurement, chance and data</td>
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</tr>
<tr>
<td></td>
<td>Structure</td>
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</tr>
<tr>
<td></td>
<td>Working mathematically</td>
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<tr>
<td>Science</td>
<td>Science knowledge and understanding</td>
<td></td>
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<tr>
<td></td>
<td>Science at work</td>
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<tr>
<td>Interdisciplinary Learning</td>
<td>Communication</td>
<td>Listening, viewing and responding</td>
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<td>Presenting</td>
</tr>
<tr>
<td>Design, Creativity and Technology</td>
<td>Investigating and designing</td>
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<td></td>
<td>Producing</td>
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<td></td>
<td>Analysing and evaluating</td>
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<td>Information and Communications Technology (ICT)</td>
<td>ICT for visualising thinking</td>
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<td>ICT for creating</td>
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<td>ICT for communicating</td>
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</tr>
<tr>
<td>Thinking Processes</td>
<td>Reasoning, processing and inquiry</td>
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<td></td>
<td>Creativity</td>
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</tr>
<tr>
<td></td>
<td>Reflection, evaluation and metacognition</td>
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</tbody>
</table>

Figure B.3: Essential Learning strands structure (VCAA 2007, p. 7)
Appendix B.4: AusVELS 2013 - 2016

The AusVELS framework for F – 10 incorporated the four Australian Curriculum learning areas already developed of English, The Humanities – History, Mathematics, and Science into the existing VELS framework, replacing their predecessors. The remaining domains of VELS continued to be utilised within AusVELS (VCAA 2012). The assessment and reporting structure of AusVELS was changed to meet the eleven learning levels of the Australian Curriculum F - 10 (Table B.1) (VCAA 2012; ACARA n.d.b). The curriculum within AusVELS was set out in relation to student developmental levels rather than their year levels (VCAA 2014a).
Appendix B.5: Australian Curriculum 2016 -

The Australian Curriculum for F-10 years includes eight learning areas, seven general capabilities, and three cross-curricular priorities (Figure B.4) (ACARA n.d.a). The learning areas consist of English, Health and Physical Education, Languages, Mathematics, Science, The Arts, Humanities and Social Science, and Technologies. The general capabilities ‘contain a set of discrete knowledge and skills’, taught within and throughout the learning areas, are Literacy, Numeracy, ICT capabilities, Ethical Understanding, Intercultural Understanding, Critical and Creative Thinking, and Personal and Social Capability (ACARA n.d.a). Whereas, the cross-curricular priorities of Sustainability, Aboriginal and Torres Strait Islander Histories and Cultures, and Asia and Australia’s Engagement with Asia can be embedded into one or more learning areas (ACARA n.d.a).
<table>
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<th>General Capabilities</th>
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<tbody>
<tr>
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<td>Literacy</td>
</tr>
<tr>
<td>Mathematics</td>
<td>Numeracy</td>
</tr>
<tr>
<td>Science</td>
<td>Information and Communication</td>
</tr>
<tr>
<td>Humanities and Social Sciences</td>
<td>Technologies capability</td>
</tr>
<tr>
<td>• F-6/7 HASS</td>
<td>Critical and Creative Thinking</td>
</tr>
<tr>
<td>• 7-10 History</td>
<td>Personal and Social Capability</td>
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<tr>
<td>• 7-10 Geography</td>
<td>Ethical Understanding</td>
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<tr>
<td>• 7-10 Civics and Citizenship</td>
<td>Intercultural Understanding</td>
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<tr>
<td>• 7-10 Economics and Business</td>
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<td>The Arts</td>
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<tr>
<td>• Dance</td>
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<tr>
<td>• Drama</td>
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<tr>
<td>• Media Arts</td>
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</tr>
<tr>
<td>• Music</td>
<td></td>
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<tr>
<td>• Visual Arts</td>
<td></td>
</tr>
<tr>
<td>Technologies</td>
<td></td>
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<tr>
<td>• Design and Technologies</td>
<td></td>
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<tr>
<td>• Digital Technologies</td>
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<tr>
<td>Health and Physical Education</td>
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<tr>
<td>Languages</td>
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<tr>
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<td></td>
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<td>Chinese</td>
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<tr>
<td>Framework for Aboriginal Languages and Torres</td>
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<td>Aboriginal and Torres Strait Islander</td>
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<tr>
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<td>Histories and Cultures</td>
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<td>Vietnamese</td>
<td>Asia and Australia’s Engagement</td>
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<td>Optional</td>
<td>with Asia</td>
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<td>Sustainability</td>
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</tbody>
</table>

Figure B.4: The Australian Curriculum F-10 structure (ACARA n.d.a)
Appendix B.6: Victorian Curriculum 2016 -

The Victorian Curriculum, based upon the Australian Curriculum, has been adjusted to reflect Victorian content (Figure B.5) (ACARA n.d.c). The general capabilities of Literacy, Numeracy, and ICT Capability in the Australian Curriculum are not included in The Victorian Curriculum F-10 design as ‘separate learning areas’, but embedded across different learning areas with students learning and applying them across the curriculum (VCAA 2014a; ACARA n.d.c).

ICT is included into multiple Victorian Curriculum F-10 areas; firstly as one of the general capabilities and then as specialist knowledge in Technologies: Digital Technology strand/subject (ACARA 2012b; Randall 2013). Schools have the choice to embed ICT specifically into Digital Technologies, English, Media Arts, Geography, and Mathematics, or individually determine how to include it into other learning areas (ACCE 2015). The aim of ICT general capabilities is to aid students in becoming competent users of ICT (Randall 2013). Digital Technologies contains the learning strands of Digital Systems, Data and Information, and Creating Digital Solutions (ACARA n.d.c) and are aimed at giving students the knowledge and skills to manage and operate ICTs in order ‘to become confident developers of information solutions by applying computational thinking’ (ACARA 2012b, p. 26). The subject of Digital Technologies aims to increase the technical capabilities of students through the use of information systems and computational thinking ‘to define, design, and implement digital solutions’ (Deloitte Access Economics & ACS 2015, p. 40). Technologies strands are valid for all students in F-8, while Digital Technology elective subjects are available for those in Years 9-10 (ACARA 2015d).
<table>
<thead>
<tr>
<th>Learning Areas</th>
<th>Capabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Arts</td>
<td></td>
</tr>
<tr>
<td>• Dance</td>
<td></td>
</tr>
<tr>
<td>• Drama</td>
<td></td>
</tr>
<tr>
<td>• Media Arts</td>
<td></td>
</tr>
<tr>
<td>• Music</td>
<td></td>
</tr>
<tr>
<td>• Visual Arts</td>
<td></td>
</tr>
<tr>
<td>• Visual Communication Design</td>
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</tr>
<tr>
<td>English</td>
<td></td>
</tr>
<tr>
<td>Health and Physical Education</td>
<td>Critical and Creative Thinking</td>
</tr>
<tr>
<td>The Humanities</td>
<td>Ethical</td>
</tr>
<tr>
<td>• Civics and Citizenship</td>
<td>Intercultural</td>
</tr>
<tr>
<td>• Economics and Business</td>
<td>Personal and Social</td>
</tr>
<tr>
<td>• Geography</td>
<td></td>
</tr>
<tr>
<td>• History</td>
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<tr>
<td>Languages</td>
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<td>Mathematics</td>
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<td>Science</td>
<td></td>
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<tr>
<td>Technologies</td>
<td></td>
</tr>
<tr>
<td>• Design and Technologies</td>
<td></td>
</tr>
<tr>
<td>• Digital Technologies</td>
<td></td>
</tr>
</tbody>
</table>

Figure B.5: The design of the Victorian Curriculum F–10 (ACARA n.d.c)
Appendix C: Post-Compulsory Learning Years Curriculum
Appendix C.1: Senior Learning Pathways in Government Schools

LEARNING PATHWAYS

Figure C.1: Senior learning pathways in Government schools (VCAA 2010a, p. 19)
Appendix C.2: Victorian Certificate of Education

The two-year program typically offers students in Year 11 Units 1 and 2, and those in Year 12, Units 3 and 4; Units 1 and 2 may be taken separately but Units 3 and 4 must be taken in sequence for the same subject (VCAA 2011). In addition, some secondary schools offer Year 10 students the option to fast track their studies through undertaking senior study units early; these results in an increase in the overall number of subjects studied or reduces the student’s study load in subsequent years (VCAA 2004). In order to obtain a VCE certificate, students must satisfactorily complete at least sixteen units, including three from the English group (with at least one Unit from level 3 or 4), and three other series of Units 3 and 4 (VCAA 2011). Study designs are developed for each VCE study area, they specify the validity years, requirements, content and assessment for that study area, each time a new study design is released it replaces all previous ones (VCAA 2011).

The current VCE IT study design is valid until the end of 2019 (VCAA 2014b). VCE IT students may enter IT studies at Units 1, 2, or 3 with no prior IT study; in any sequence, Unit 3 is a prerequisite to Unit 4, and students may undertake any number of sequences (VCAA 2014b). Government documents indicate that the enhancement of ICT knowledge acquired by younger students occurs at the VCE level, creating links between their learning (VCAA 2010b).

Table C.1 provides a summary of senior IT subjects from 1981 to the present day. Early senior computing studies consisted of Computer Science, first offered in Victoria in 1981 in the Higher School Certificate (Tatnall & Davey 2004), initially having content defined by academics and teachers rather than by the education department (Tatnall & Davey 2008). Alongside Computer Science, either Computers in Business and Government, or Computer in Science and Engineering was to be studied (Tatnall & Davey 2008).
### Table C.1: Historical summary of senior secondary IT studies

<table>
<thead>
<tr>
<th>Years</th>
<th>Subjects Offered</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>VCE</th>
<th>IT</th>
<th>Units 1 and 2</th>
<th>Units 3 and 4</th>
<th>Units 3 and 4</th>
<th>Units 3 and 4</th>
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<tbody>
<tr>
<td>1991-1997</td>
<td>Information Technology</td>
<td>Information Processing and Management</td>
<td>Information Systems</td>
<td>Information Technology in Society</td>
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<tr>
<td>1998-2006</td>
<td>Information Technology</td>
<td>Information Processing and Management</td>
<td>Information Systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2007-2015</td>
<td>Information Technology</td>
<td>Information Technology Applications</td>
<td>Software Development</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2016-2019</td>
<td>Computing</td>
<td>Informatics</td>
<td>Software Development</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table C.1: Historical summary of senior secondary IT studies

### Appendix C.3: Vocational Education and Training

Students who undertake computing studies within VET IT related certificates are able to choose from a variety on offer. Certificates range from Level I to IV in topics such as IT, Digital Media, and Computer Systems; students may study more than one type of VET certificate during their VCE. Both the number and type of certificates on offer have altered over the years; examples of selected years are in Table C.2 (VCAA 2016). Other VET certificates related to IT are available in areas such as Business Services, and Electrical and Electronics.
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Certificate I Information Technology</td>
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<tr>
<td>Certificate I in Information, Digital Media &amp; Technology</td>
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<tr>
<td>Certificate II Information Technology</td>
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<td>✓</td>
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<tr>
<td>Certificate Information Technology (Applications)</td>
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<tr>
<td>Certificate II in Information, Digital Media &amp; Technology</td>
<td>✓</td>
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</tr>
<tr>
<td>Certificate III Information Technology</td>
<td>✓</td>
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<tr>
<td>Certificate III Information Technology (General)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Certificate III Information Technology – IT Vendor Program</td>
<td>✓</td>
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</tr>
<tr>
<td>Certificate III Information Technology (Network Administration)</td>
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</tr>
<tr>
<td>Certificate III Information Technology (Software Applications)</td>
<td>✓</td>
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<tr>
<td>Certificate III in Information, Digital Media &amp; Technology</td>
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<tr>
<td>Certificate IV Information Technology</td>
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<td>✓</td>
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<td></td>
</tr>
<tr>
<td>Certificate IV Information Technology (General)</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Certificate IV Information Technology Networking</td>
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</tr>
<tr>
<td>Certificate IV Information Technology (Client support)</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Certificate IV Information Technology (Support)</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Certificate IV Information Technology (Websites)</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Certificate IV Information Technology (Web site Administration)</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Certificate IV in Computer Systems Technology</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Certificate IV Information Technology (Network Management)</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Certificate IV Information Technology (Multimedia)</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Certificate IV Digital and Interactive Games</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
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</tr>
<tr>
<td>Certificate IV Digital Media Technologies</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diploma of Digital and Interactive Games</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
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</tr>
</tbody>
</table>

Table C.2: Information Technology certificates studied in VET
Appendix C.4: Australian Curriculum / Victorian Curriculum for Senior Students

The developed senior ranges of subjects are below (ACARA n.d.a):

**English**
- Essential English
- English as an Additional language or Dialect
- English
- Literature

**Mathematics**
- Essential Mathematics
- General Mathematics
- Mathematical methods
- Specialist Mathematics

**Science**
- Biology
- Chemistry
- Earth and Environmental Science

**Humanities and Social Science**
- Ancient History
- Modern History
- Geography
Appendix D: Phase 1 Research Documentation

Appendix D.1: Email to Interested Teachers

Subject: Teacher’s Perceptions of ICT Education Research

Dear __________

My name is Christine McLachlan and I am a Doctor of Philosophy student at Deakin University researching teacher perceptions of Information Communication Technology (ICT) education. One of my supervisors Associate Professor Annemieke Craig has mentioned this research to you in the past and indicated that you had an interest in possibly being involved.

I am seeking your permission to conduct an interview with you; the interview should take no longer than one hour. You are invited to talk about your teaching background and qualification/skills in ICT, ICT education and its delivery, your perceptions of teaching with ICT’s, support available for teaching with ICT’s, and student engagement and learning with ICT’s.

Attached are copies of the plain language statement, consent forms, and interview questions, and once conducted there is no more involvement required of you in this research.

The object of this research is to collect information to assist in understanding teacher perceptions of ICT education. The information collected will be anonymous, and no personal or sensitive information is required. Any references to your comments will be through a pseudonym. The researchers request permission to audio record the interview so that the information collected can be later transcribed.

Involvement in this research is voluntary and you may choose not to participate.

Please read the attached documentation, and should you have any further questions please do not hesitate in contacting me.

The researchers are:

Student: Ms Christine McLachlan
Supervisors: Asst. Prof. Annemieke Craig, School of Information Systems, and Asst. Prof. Jo Coldwell, School of Science and Technology

If you are interested in participating, please contact me by email.

We appreciate your time and thank you for your assistance.

Contact Details: Ms Christine McLachlan
School of Information System
Faculty of Business and Law
Deakin University
Locked Bag 20000
Geelong, VIC 3220
Email: camcla@deakin.edu.au
Appendix D.2: Plain Language Statement

PLAIN LANGUAGE STATEMENT

TO: Teacher involved with ICT’s.

<table>
<thead>
<tr>
<th>Date:</th>
<th>January 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Project Title:</td>
<td>Teachers’ Perceptions of Delivering ICT Education In Victorian Secondary Schools</td>
</tr>
<tr>
<td>Principal Researchers:</td>
<td>Ass. Profs. Annemieke Craig and Jo Coldwell-Neilson</td>
</tr>
<tr>
<td>Student Researcher:</td>
<td>Christine McLachlan</td>
</tr>
</tbody>
</table>

The purpose of this research is to explore teachers’ perceptions of Information and Communication Technology (ICT) education delivery and its impacts on students’ engagement with their learning. Overall, this project will be undertaken in two stages. A maximum of twelve teachers will be asked to participate in the first stage.

I am inviting you to take part in this research project. As part of this research, I wish to conduct interviews with teachers involved in teaching ICT education or teaching students with ICT tools. The interview will be conducted at a time, place and communication method suitable for you; I anticipate will take no more than one hour. The interviews are planned to be conducted between January and May 2013. A copy of the proposed interview question pool is attached, not all of the questions will be applicable to you.

I request permission to audio record the interview so that the information collected can be later transcribed. Results from this research phase will inform the second stage of the research and will be presented in a doctoral thesis. There is the possibility that the outcomes of this research will be presented in academic publications. All data will be retained for a minimum of 6 years after final publication of the thesis as per Deakin University regulations. A copy of the final thesis is available upon request.

The information collected will be anonymous, and no personal or sensitive information is required; the privacy of all participants is assured. Pseudonyms will be used for all participants.

**Participation in this research project is voluntary and you are not obliged to take part.** Consent is required by all participants, you can provide written, verbal or implied consent. If you decide later to withdraw please notify Ms McLachlan, however it is not possible to withdraw once data has been collected. Copies of consent forms are attached. If you have any questions please contact Ms McLachlan for clarification.
Your perceptions of ICT education are valued and may be used in the future by other researchers. There are no costs or risks to you through involvement in this research. Interview participants will be offered a small thank you gift at the conclusion of their involvement.

This research does not have any external support or sponsorship. The research project is regularly monitored by two university supervisors.

Complaints

If you have any complaints about any aspect of the project, the way it is being conducted or any questions about your rights as a research participant, then you may contact:

The Manager, Research Integrity, Deakin University, 221 Burwood Highway, Burwood Victoria 3125, Telephone: 9251 7129, research-ethics@deakin.edu.au

Please quote project number BL-EC 66-12.

The researchers responsible for this project are:

<table>
<thead>
<tr>
<th>Student Researcher:</th>
<th>Supervisors:</th>
<th>Supervisors:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ms Christine McLachlan Faculty of Business and Law School of Information Systems <a href="mailto:camclia@deakin.edu.au">camclia@deakin.edu.au</a></td>
<td>Ass Prof Annemieke Craig Faculty of Business and Law School of Information Systems <a href="mailto:annemieke.craig@deakin.edu.au">annemieke.craig@deakin.edu.au</a> Ph: 52272152</td>
<td>Ass. Prof Jo Coldwell-Neilson Faculty of Science and Technology School of Information Technology <a href="mailto:jo.coldwell-Neilson@deakin.edu.au">jo.coldwell-Neilson@deakin.edu.au</a> Ph: 52271417</td>
</tr>
</tbody>
</table>
Appendix D.3: Teacher Interview Consent Form

TO: Teacher involved with ICT’s

<table>
<thead>
<tr>
<th>Teacher Consent Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date:</td>
</tr>
<tr>
<td>Full Project Title:</td>
</tr>
<tr>
<td>Reference Number:</td>
</tr>
</tbody>
</table>

I have read and I understand the attached Plain Language Statement. I freely agree to participate in this project according to the conditions in the Plain Language Statement. I have been given a copy of the Plain Language Statement and Consent Form to keep. The researcher has agreed not to reveal my identity and personal details, including where information about this project is published, or presented in any public form. I freely agree to the interview being audio recorded.

Participant’s Name (printed)

Signature .......................................................... Date

Please complete and return this consent form to the address below, phone, or email me at camcla@deakin.edu.au if you wish to take part in this research.

Ms Christine McLachlan  
Deakin University  
Faculty of Business and Law  
School of Information Systems  
camcla@deakin.edu.au
Appendix D.4: Interview Guideline for Classroom ICT Teachers

**Classroom level ICT Teachers Interview Question Guideline – Phase 1 Round 1**

1. Could you please describe your teaching and ICT backgrounds?
2. What are your current interests in ICT? (teaching experience, teaching qualifications, educational background, position at the school, multiple domains, workload, specialisations, ICT training, ICT interests, level of ICT confidence and competence, PD’s, updated training, own ICT use, personal enjoyment, record teacher gender)
3. Can you tell me how you came to teach ICT? (choice, necessity (integrated), interest, as a role model, attitude to teaching ICT, )
4. How do you see the relationship between computing and education becoming in the near future?
5. Could you please describe for me the class environment for teaching ICT compared to traditional teaching? (competitive, interactive, cooperative, individualised, seating, student dominance, student involvement – active or passive of combination, teacher roles, guiding, exploring, sharing, learning by doing)
6. What makes a good ICT class session?
7. Could you please briefly describe your school’s technology support system? (reliability, coverage, access, operating system, wireless coverage, personal assistance offered)
8. What types of ICT tools does your school utilise?
9. With the introduction of teaching ICT and using ICT tools throughout the curriculum, has this changed the students’ attitude/engagement with ICT and learning? (engagement, interest, behaviour, attention span, learning focus, learning roles, student performance, amount of work completed, control of self-learning, organisation of learning, teaching style, attitude, aspirations)
10. What opportunities do teachers have in the promotion or explanation of ICT as a career to students? Explain
11. What is the school’s student to computer ratio?
12. Does school offer VET and/or VCE ICT subjects?
13. How does your school interpret and use the VELS ICT framework to produce the ICT curricula? (who’s involved, how formulated, support materials produced for teachers, how lessons plans prepared - individually, school based - coordinate with ICT teachers, coordinated with other subject teachers)
14. In planning ICT, how does the school ensures that all students meet the VELS level 6 requirements by the end of year 10?
15. If ICT is not taught as a core subject in the middle years and student do not take any electives, how are their abilities assessed?
16. Do you find the VELS ICT guidelines a good representation of workplace ICT? Explain (what other aspects would you like to see included, adequate preparation for students further studies or work)
17. What types of resources are provided for students to assist them with their ICT learning? (teacher notes, handouts, textbooks, online information, school Intranet)
18. What types of computer activities, operating systems and software packages do you teach the students to use? (Collaborative and group learning, individual study, real-life problems, Windows, Mac, Adobe, Microsoft, email, other)
19. What delivery methods for ICT are used this year to teach students at this
school? (core, integrated [with what areas], ICT tools used, elective, combination, specialist teacher, multiple teachers, year levels, Laptop/Notebook program, advantages, disadvantages, any recent changes in delivery method and why)

20. Why has this school chosen to deliver ICT in this manner?
21. How do you/would you prefer to teach ICT? (I, C, both, single gender classes, advantages, disadvantages)
22. What do you see are the advantages and disadvantages of interdisciplinary ICT teaching? (loss of specialisation)
23. (if integrated) How long has integrated ICT been taught at this school, how has it been accepted? (by teachers, by students)
24. Do you consider that the art of teaching ICT has changed with the introduction of integrated teaching? How? (advantages, disadvantages, broader knowledge base, loss of specialisations)
25. Have you seen any changes in student interest in ICT over the last few years?
26. Why do you think this has occurred?
27. Have you noticed any gender differences in ICT interest?
28. Have you noticed any age differences in ICT interest?
29. In your opinion, how do students see the use of ICT at school? (a support tool, a career)
30. What advantages and disadvantages do you see with ICT?
31. Have the number of students interested in choosing ICT electives (and VCE ICT) changed in the last few years?
32. How have they changed?
33. Why do you think this has happened? [gender differences, subject naming, curriculum content, delivery]
Appendix D.5: Interview Guideline for Leading ICT Teachers

Leading ICT Teachers Interview Question Guideline – Phase 1 Round 2
1. How long have you been teaching?
2. How long have you been teaching at this school?
3. How long have you been teaching ICT?
4. Have you always taught ICT?
   a. If not, what other areas have you taught?
5. Have you taught ICT overseas?
6. How would you compare ICT teaching between overseas and Australia?
7. What are your current employed position and broad responsibilities?
8. What is your current teaching load? (e.g. 2 x Yr 7 English, Yr 12 VCE IT, etc.)
9. How many and what positions do the ICT staff hold at this school?
10. Do you have any formal qualification in ICT? If so please describe.
11. Do you have any industry experience in ICT? If so please describe briefly
12. Where does your interest in ICT come from?
13. How is ICT education delivered at the different year levels in your school?
14. Have you experienced different delivery methods?
   a. If so, please elaborate on the differences
15. What do you see as the advantages or disadvantages of these different methods?
16. What is your preference for ICT delivery?
17. In your opinion, should all students be ICT literate by the time they leave school?
18. Will all the students from your school be ICT literate by the time they leave school?
   a. If so, how is this achieved?
   b. If not, why not?
19. What issues does the school face in ensuring that all the students are ICT literate?
20. In your opinion, how successful is the teaching of ICT subjects in your school?
21. In your opinion, how successful is the integration of ICT in the teaching of other disciplines in your school?
22. What is the level of engagement of students in using ICT?
23. What is the level of engagement of students learning ICT as a discipline?
24. What is the level of engagement and uptake with the-VCE ICT curriculum?
25. What could be done to improve the uptake of ICT studies by middle and senior school students?
26. What types of ICT support do you provide to other staff members?
27. What types of ICT support do you seek from others from within and outside of your school?
Appendix D.6: Interview Guideline for Head ICT Teachers

_Head ICT Teachers Interview questions Guideline – Phase 1 Round 3_

1. Could you please describe your teaching background, your ICT background, your current interests in ICT and use of ICTs?
2. Could you please describe your ICT qualifications, ICT-related professional development, its usefulness, and current ICT skills?
3. Could you please describe how you see students interest in ICT study, terms used for ICT subjects, advantages and disadvantages of teaching ICT education, and your interest in ICT education?
4. Could you please describe the types of ICT education delivery you have been involved with, the advantages and disadvantages of each delivery method, which method you prefer, coping with changes of delivery methods, impacts on students due to delivery method, and how you see students views of ICT education delivery?
5. Could you please describe the level of importance of ICTs in student learning, any differences in the class preparation and delivery with ICT than without, teaching aspects outside your lesson plans, and the advantages and disadvantages of teaching with ICTs?
6. Could you please describe the support systems available for ICTs and teaching with ICTs, the sufficiency of such support, and whether you have sought or provided assistance to others?
7. Could you please describe the following points in relation to students and their classes with and without ICTs?
   a. the level of engagement
   b. the rate of learning
   c. expanding students’ abilities
   d. PDs and changes to teaching
8. Could you please describe students ICT skills and student interest in ICT beyond compulsory learning?
Appendix D.7: Advertisement

ADVERTORIAL FEATURE

COMPUTING PROFESSIONAL DEVELOPMENT

WHAT DO YOU THINK?

Hello, my name is Christine McLachlan and I am seeking your help to progress my research at Deakin University. Recently I conducted interviews with computing teachers and found they had major concerns about computing skills. They said they were regularly being asked to answer questions about computing and complained about inadequate professional development for staff.

I need your assistance to collect more information on these matters. I would like to explore the opinions of teachers who use computers in their classrooms about professional development opportunities currently offered. With luck, and your help, the results of my investigations can improve future teacher computer training.

I will be collecting information through an online survey and encourage you to take part. The survey should take 10-15 minutes to complete and consists of 35 questions. Most of the questions have predefined answers that you can select from, although a few require a typed response. The survey is open until 9/1/2015.

Questions ask you about your school, computing skills, past computer training, future computer professional development wishes, and demographic information about yourself. All information is collected anonymously and cannot be linked back to you or your school.

Please spread the word about my research and this survey to other teachers so I can get as broad a response as possible.

Two prizes of $200 JB eGift cards are on offer, although you have to be in it to win it. The prizes will be distributed by 31/1/2015.

If you are interested in being part of this research, more details and the survey can be found at tinyurl.com/computerPD or deskinbuslaw.co.1.qualtrics.com/SE/?SID=SV_eyBNg7t1IVi6q6V.
Appendix E: Phase 2 Research Documentation

Appendix E.1: Plain Language Statement

PLAIN LANGUAGE STATEMENT
TO: School Teachers

Plain Language Statement

Date: September 2014
Full Project Title: Teachers Perceptions of Information and Communication Technology Education
Principal Researchers: Ass. Profs. Annemieke Craig and Jo Coldwell-Neilson
Student Researcher: Christine McLachlan

The main purpose of this research is to explore teachers’ experiences with computing professional development and their opinions of computing skills related to their teaching. This is the second phase of a two-phased research project. The first phase collected data from teachers’ specifically interest in computing education through interviews. The results revealed that problems existed with computing professional development and teachers’ computing skills. This second phase seeks to further explore these issues.

I am inviting you to take part in this research project. As part of this research, I wish to conduct an online survey with school teachers who use computing tools in their teaching. The survey will be conducted through the online survey provider, Qualtrics, and should take around 10-15 minutes to complete. There is no maximum or minimum number of respondents sought for the survey. The online survey is to be available until January 9 2015.

The results from this research phase will be presented in a doctoral thesis and academic publications. All data will be retained for a minimum of 6 years after final publication of the thesis as per Deakin University regulations. This research project is monitored regularly by the supervisors listed at the bottom of this document.

**Participation in this research project is voluntary and you are not obliged to take part.** Consent is required by all respondents. In this research project consent is implied through the agreement to access and complete the online survey. Once the survey has been submitted there is no option of withdrawal as no identifier is stored with the data. If you have any questions please contact Ms McLachlan for clarification.

Your experiences of computing professional development are highly valued and may be used in the future by other researchers and educational institutions. The research outcomes may benefit educational departments, schools, professional development providers, teachers, and future ICT professional development.
The cost to you is minimal, it includes your time to complete the survey and the costs of using the Internet to complete the survey. You will not be reimbursed for these expenses. However there will be two prize incentives offered, these will be randomly allocated by the end of January 2015. The prizes consist of two $200 JB Hi Fi eGift cards. The eGift card can be redeemed online, or printed and used in-store. The eGift cards will be emailed to the winners through the JB website. The winners will be asked to verify their receipt of the eGift card. To enter the draw respondents will be asked to submit their email address at the end of the survey. This data is stored separately from your survey answers.

Your privacy is assured, once prizes are distributed and receipt acknowledged all email contacts will be deleted. Deletion of emails will occur prior to any data analysis. Your email details will not be used for any other purpose other than the prize draw. No identifiable information will be included in any publicised research outcomes. The survey can only be completed once by each respondent.

The research does not have any external support or sponsorships. The research project is regularly monitored by two university supervisors.

Complaints
If you have any complaints about any aspect of the project, the way it is being conducted or any questions about your rights as a research respondent, then you may contact:

The Manager, Research Integrity, Deakin University, 221 Burwood Highway, Burwood Victoria 3125, Telephone: 9251 7129, research-ethics@deakin.edu.au

Please quote project number BL-EC 48-14.

The researchers responsible for this project are:

<table>
<thead>
<tr>
<th>Student Researcher:</th>
<th>Supervisors:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ms Christine McLachlan Faculty of Business and Law School of Information and Business Analytics <a href="mailto:camcla@deakin.edu.au">camcla@deakin.edu.au</a></td>
<td>Ass Prof. Annemieke Craig Faculty of Business and Law School of Information and Business Analytics <a href="mailto:annemieke.craig@deakin.edu.au">annemieke.craig@deakin.edu.au</a> Ph: (03) 52272152</td>
</tr>
<tr>
<td>Ass. Prof. Jo Coldwell-Neilson Faculty of Science Engineering &amp; Built environment School of Information Technology <a href="mailto:jo.coldwell-neilson@deakin.edu.au">jo.coldwell-neilson@deakin.edu.au</a> Ph: (03) 52271417</td>
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Appendix E.2: Online Questionnaire and Survey Codebook

Combined

KEY:
Question or Statement [variable name]
Code Number Category [variable name]

All questions with the exception of questions 6 and 39 required a single response. Questions 6 and 39 allowed multiple responses.

Section 1: About Your School

Q 1: In what Australian State or Territory do you teach? [Q1_State]

1  Australian Capital Territory
2  New South Wales
3  Northern Territory
4  Queensland
5  South Australia
6  Tasmania
7  Victoria
8  Western Australia
9  Other [Q1_StateTEXT]

Q 2: In what type of school do you teach? [Q2_SType]

1  Independent, Catholic
2  Government
3  Independent, non-Catholic
4  Other [Q2_STypeTEXT]

Q 3: Which of the following best matches the levels of education offered at your school? [Q3_SLevels]
P=Preparatory, F=Foundation

1  Preschool
2  P/F to Year 6
3  P/F to Year 8
4  P/F to Year 10
5  P/F to Year 12
6  Years 7 to 10
7  Years 7 to 12
8  Years 9 to 12
9  Years 11 to 12
10 Special Needs Education
11 Other [Q1_SLevelsTEXT]
Section 2: About Computing Skills

Q 4: How often do YOU use computer tools in your teaching? [Q4_Regularity]
For example, Smartboards, Tablets, Desktop Computers, Laptops, Netbooks, Data projectors, etc...

1  Never
2  Less than once a week
3  Once a week
4  Multiple times a week
5  Once a day
6  Multiple times a day

Q 5: For how many years has your teaching involved STUDENTS using computers in the classroom? [Q5_Student]
For example, Students creating Blogs, Podcasts, Internet searching, word processing, etc...

1  Less than 1 year
2  1 to 3 years
3  4 to 6 years
4  7 to 9 years
5  10 to 12 years
6  More than 12 years

Q 6: Please tick the box for each of the below statement completions that you agree with.
In my opinion, a core computer class:

1  Should teach all computing concepts and ICT Literacy [Q6_1_Opinion]
2  Is essential to teach computing concepts [Q6_2_Opinion]
3  Is essential to make sure all our students are ICT literate [Q6_3_Opinion]
4  Should only teach the fundamentals of using computers [Q6_4_Opinion]
5  Is not necessary because computing is integrated into other subjects [Q6_5_Opinion]
6  Is not necessary [Q6_6_Opinion]

Q 7: How would you rate your own computing skills? [Q7-OwnSkill]

1  Non-existent
2  Novice
3  Intermediate
4  Advanced
5  Superior
Q 8: Regardless of whether it is in your specialist curriculum area, how often do you teach computing concepts in classes? [Q8_Often]
Eg. File management, data storage, word processing, etc...

1 Never
2 Rarely
3 Sometimes
4 Quite Often
5 All the time

Q 9: Do you consider your computing skills sufficient to teach computing education concepts? [Q9_Sufficient]

1 Rarely
2 Sometimes
3 Often
4 Most of the time
5 Always

Q 10: Does your computing skill level impact on the way you teach computing education? [Q10_Impact]

1 Yes
2 No
Please explain [Q10_ImpactTEXT]

Q 11: How prepared do you consider yourself to implement Digital Technology capabilities for the Australian Curriculum? [Q11_Preparedness]

1 Not prepared
2 Underprepared
3 Moderately prepared
4 Well prepared
5 Very well prepared

Section 3: About Your Past Computer Professional Development Experiences

Q 12: During your teaching career how much computing professional development have you participated in? [Q12_PastParticipation]

1 None (Skip to Q 23)
2 Not enough
3 Enough
4 Many
5 A great many
Q 13: What problems have you encountered in keeping your computing knowledge up-to-date? [Q13_PastProblemsTEXT]

Textural responses

Q 14: Has the computing professional development you have participated in met your needs? [Q14_PastNeeds]

1 Rarely
2 Sometimes
3 Often
4 Most of the time
5 Always

Q 15: Has the computing professional development been at an appropriate knowledge level for you? [Q15_PastPDLevel]

1 Rarely
2 Sometimes
3 Often
4 Most of the time
5 Always

Q 16 to 18: Think about a good computing professional development session you have participated in. [Q16-18_PDGd Good]

Q 16: Why was it good for you? [Q16_PastGoodTEXT]

Textural response

Q 17: Were you required to do any preparation? [Q17_PastGPreparation]

1 Yes, if so, what? [Q17_PastGPrepTEXT]
2 No

Q 18: Did you receive any follow-up? [Q18_PastGFollow]

1 Yes, if so, what? [Q18_PastGFollowTEXT]
2 No

Q 19 to 21: Think about a poor computing professional development you have participated in. [Q19-21_PDPoor]

Q 19: Why was it bad for you? [Q19_PastPoorTEXT]

Textural response
Q 20: Were you required to do any preparation? [Q20_PastPPreparation]

1  Yes, if so, what? [Q20_PastPPrepTEXT]
2  No

Q 21: Did you receive any follow-up? [Q21_PastPFollow]

1  Yes, if so, what? [Q21_PastPFollowTEXT]
2  No

Q 22: Have you ever presented content at a computing professional development session? [Q22_PastPresented]

1  Yes
2  No

Q 23: Are there any further comments relating to your involvement in computing professional development or computing skills that you may like to add? [Q23_PastFurther]

1  Yes, if so, what? [Q23_PastFurtherTEXT]
2  No

Section 4: About Your Future Computing Professional Development Wishes

For questions 24, 25, 26, 28, 29, 30 and 31 the following five codes apply to each lettered subsection.

1  No preference
2  Slightly prefer
3  Prefer
4  Strongly prefer
5  Very strongly prefer

Q 24: Please indicate your future preferences for each of the following online delivery methods of computing professional development. [Q24_FutureOnline]

A  Online documents/tutorials provided by an educational department [Q24_1_FutureOnline]
B  Interactive online resources (webinar) [Q24_2_FutureOnline]
C  Static online resources (help sheets) [Q24_3_FutureOnline]
D  Online forums [Q24_4_FutureOnline]
E  YouTube clips [Q24_5_FutureOnline]
F  Webcasts /Podcasts [Q24_6_FutureOnline]
G  Video conference [Q24_7_FutureOnline]
H  Online Exemplars of computer use in other classes [Q24_8_FutureOnline]
Q 25: Please indicate future preferences for each of the following face-to-face delivery methods of computing professional development. [Q25_FutureF2F]

A  Conference attendance [Q25_1_FutureF2F]
B  Professional development not located at your school [Q25_2_FutureF2F]
C  Professional development located at your school [Q25_3_FutureF2F]
D  Specific workshops [Q25_4_FutureF2F]
E  Consultancy presented [Q25_5_FutureF2F]
F  School employee presented [Q25_6_FutureF2F]
G  One-on-one consultation with school staff [Q25_7_FutureF2F]
H  Seek information from a family member or friend [Q25_8_FutureF2F]

Q 26: Please indicate your future preference for each of the following formal education delivery methods of computing professional development. [Q26_FutureFormal]

A  Online accredited courses [Q26_1_FutureFormal]
B  Accredited courses you attend [Q26_2_FutureFormal]
C  Distance education courses through the mail [Q26_3_FutureFormal]

Q 27: Are there any other types of computing professional development delivery methods you would be interested in for the future? [Q27_FutureOther]

1  Yes, please list [Q27_FutureOtherTEXT]
2  No

Q 28: What type of future computer professional development content would you prefer to receive? [Q28_FutureContent]

Please select your preference for each of the following.

A  Content that fits school priorities [Q28_1_FutureContent]
B  Content that fits the curriculum [Q28_2_FutureContent]
C  Content that fits your teaching needs [Q28_3_FutureContent]
D  Content that fits your personal needs [Q28_4_FutureContent]
E  A session on a single concept [Q28_5_FutureContent]
F  A session on a broad range of concepts [Q28_6_FutureContent]

Q 29: When would you prefer computer professional development to be held. Please select your preference for each of the following. [Q29_FutureWhen]

A  Before school [Q29_1_FutureWhen]
B  During school hours [Q29_2_FutureWhen]
C  Immediately after school [Q29_3_FutureWhen]
D  In the evenings [Q29_4_FutureWhen]
E  On school days during free periods [Q29_5_FutureWhen]
F  On student free days [Q29_6_FutureWhen]
G  On the weekend [Q29_7_FutureWhen]
H  During school holidays [Q29_8_FutureWhen]
Q 30: How often would you prefer computer professional development to be held? [Q30_FutureOften]
Please select your preference for each of the following.

A  Not at all [Q30_1_FutureOften]
B  Only once [Q30_2_FutureOften]
C  One during each term [Q30_3_FutureOften]
D  Regularly during one term [Q30_4_FutureOften]
E  Regularly during two terms [Q30_5_FutureOften]
F  Regularly throughout the year [Q30_6_FutureOften]

Q 31: How long would you prefer computer professional development to go for? Please select your preference for each of the following. [Q31_FutureLong]

A  Short sessions of less than one hour [Q31_1_FutureLong]
B  Sessions that last for up to two hours [Q31_2_FutureLong]
C  A half-day session [Q31_3_FutureLong]
D  A full day session [Q31_4_FutureLong]
E  Sessions run over successive days [Q31_5_FutureLong]

Q 32: What would be the maximum distance you would be prepared to travel to attend computing professional development? [Q32_FutureDistance]

1  Only to my employed school
2  Less than 50 km
3  51 to 100 km
4  101 to 150 km
5  151 to 200 km
6  201 to 500 km
7  Greater than 501 km

Q 33: How much would you personally be prepared to pay for computing professional development (PD)? [Q33_FutureDollars]

1  No amount (school should pay for PD and travel)
2  Travel expenses only (school should pay for PD)
3  Under $50
4  $51 to $100
5  $101 to $200
6  $201 to $300
7  Greater than $301

Section 5: About Yourself

Q 34: Are you: [Q34_Gender]

1  Male
2  Female
Q 35: How old are you? [Q35_AgeRange]

1 30 years or under
2 31 to 40 years
3 41 to 50 years
4 51 to 60 years
5 Over 60 years

Q 36: How many years have you been teaching? [Q36_TYears]

1 5 years or less
2 6 to 10 years
3 11 to 15 years
4 16 to 20 years
5 21 to 25 years
6 More than 25 years

Q 37: Do you have any formal qualifications in computing education? [Q37_ITQualification]

1 Yes
2 No

Q 38: Do you teach in a specialist curriculum area? [Q38_Specialist]

1 Yes. If so, please list all [Q38_SpecialistTEXT]
2 No

Q 39: Which student levels do you most frequently teach? [Q39_TLevels]

1 Preschool [Q39_1_TLevels]
2 Preparatory/Foundation [Q39_2_TLevels]
3 Year 1 [Q39_3_TLevels]
4 Year 2 [Q39_4_TLevels]
5 Year 3 [Q39_5_TLevels]
6 Year 4 [Q39_6_TLevels]
7 Year 5 [Q39_7_TLevels]
8 Year 6 [Q39_8_TLevels]
9 Year 7 [Q39_9_TLevels]
10 Year 8 [Q39_10_TLevels]
11 Year 9 [Q39_11_TLevels]
12 Year 10 [Q39_12_TLevels]
13 Year 11 [Q39_13_TLevels]
14 Year 12 [Q39_14_TLevels]
15 Special Needs Education [Q39_15_TLevels]
16 Other [Q39_16_TLevels], [Q39_16_TLevelsTEXT]
Q 40: During you life where were you first introduced to computers? 

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[Q40_Introduced]
Appendix E.3: Online Questionnaire Screenshot

Section 2.

About Computing Skills

Q4. How often do **YOU** use computer tools in your teaching?
For example: Smart Boards, Tablets, Desktop computers, Laptops, Net-books, Data projectors, etc...

☐ Daily
☐ Weekly
☐ Monthly
☐ Occasionally
☐ Rarely
☐ Never

Q5. Please tick the box for each of the below statement completions that you agree with:

In my opinion, a stand-alone computing class:

☐ Should teach all computing concepts and computer literacy
☐ Is essential to teach computing concepts
☐ Is essential to make sure all our students are computer literate
☐ Should only teach the fundamentals of using computers
☐ Is not necessary because computing is integrated in other subjects
☐ Is not necessary
Appendix F: Additional Information for Phase 1 Interview Participants

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<th>Student ICT Access</th>
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<td>Sarah</td>
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<td>3</td>
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<td>Matthew</td>
<td>I, E 9 &amp; 10</td>
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<td>2 at school, 2 network based</td>
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<td>Grace</td>
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<td>LT/NB</td>
<td>Self and others</td>
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<td>1:1</td>
<td>LT/NB</td>
<td>2 IT managers and 1 network manager over 5 campuses</td>
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<td>C &amp; I</td>
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<td>DT lab, DT in classrooms</td>
<td>self</td>
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Table F.1: Interview participants additional information

Key to table:

C - Core

I - Integrated

E - Elective

DT - Desktops

LT/NB - Laptops, Netbooks or Notebooks
Appendix G: Phase 1 NVivo Report Documents

Appendix G.1: NVivo Project Summary

Project Summary
PhD Stage 1 analysis
19/10/2016 9:57 AM

\cifs-g.its.deakin.edu.au\camcla\My Documents

Teachers perceptions of ICT education in Victorian secondary schools

Created By: camcla
Created On: 20/01/2014 9:37 AM
Last Modified: camcla
Last Modified: 9/04/2014 1:01 PM

Case Classifications
### Appendix G.2: An NVivo Node Summary Page

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Appendix G.3: Final NVivo Node Structure

- ICT Education
  - 7 + 8
  - 9 + 10
  - 11 + 12
  - Comparison to Overseas
  - Curriculum Comments
  - Negative Comments

- ICT Education / ICT Education Delivery
  - Changing delivery
  - Combined learning
  - Core
  - Future Delivery
  - Personal Preference
  - Resources

- ICT Education / ICT Support
  - Network
  - Non-Teaching Support
  - Providing Support
  - Receiving Support

- Teachers / Teacher Interest
  - Enjoyment
  - First Interest

- Teachers / Teacher Qualifications
  - Tertiary Studies
    - ICT Tertiary Training
    - Non-ICT Tertiary Studies
  - Industry Experience
  - Negative comment
  - Professional Development
    - ICT PD
    - Non-ICT PD

- Teachers / Teaching with ICTs
  - Teacher Enthusiasm
  - Advantages
  - Class preparation
  - Disadvantages
  - Initiator
  - Need for Specialisation

- Student Learning
  - Learning
    - Associated Learning
- Other Learning
- Peer learning
- Self-learning
  - Engagement & Attitude
  - Class Environment
  - Computer Access
  - ICT Careers
- Demographics
  - Name
  - School Type
  - Region
  - Gender
  - Teaching Years
    - Total
    - ICT
    - Current school
  - ICT Qualified
  - ICT Delivery at School
  - Current Student Years Taught
  - Teaching Level
  - Employed Position
  - Technical Support in School
  - Teaching Areas
  - Overseas Teaching
  - Access
  - School Equipment
  - School Size
  - School Student Numbers

All demographics Exported to EXCEL – for Classifications
Appendix G.4: NVivo Node Structure Screenshot for Teacher Qualifications