

School of Education

**Investigating Students' Perceptions of the Learning Environment,
Use of ICT, Self-Efficacy, and Enjoyment in Primary School
Classrooms: Effects and Determinants**

Siobhan Kathleen Galos

This thesis is presented for the Degree of

Doctor of Philosophy

of

Curtin University

April 2018

DECLARATION

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

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



Siobhan Kathleen Galos

12 April 2018

ACKNOWLEDGEMENTS

The completion of this thesis would not have been possible without the support of several people. I would like to take this opportunity to thank those who encouraged, guided, and supported me through this journey, both professionally and personally.

This thesis would not have come to fruition without the level of guidance, wisdom, patience, and support provided by my supervisor, Associate Professor Jill Aldridge, who believed in me and held my hand every step of the way. Thank you to the staff of Curtin University for your assistance, including Kate Ala'i, who supported me through the initial research process. Thank you also to Dr Katrina McChesney (field of education) for editing this thesis according to the Australian Standards for Editing Practice. Your attention to detail was simply superb. I would also like to acknowledge the contribution of an Australian Government Research Training Program Scholarship in supporting this research.

I would like to thank and acknowledge Catholic Education Western Australia (CEWA) for allowing me to conduct research within their schools. Thank you also to the Catholic Education Commission of Western Australia (CECWA) for awarding me a doctoral scholarship to assist with the completion of my thesis. I am incredibly grateful and feel proud to work within such a wonderful school system.

I am particularly grateful to the school principals and teachers who agreed to assist me in my endeavours by allowing me into their schools and classrooms to conduct this research. These staff were so generous with their time, despite their busy schedules. I will be forever indebted to you all. I also sincerely thank the students who participated in the research and their parents for granting permission. Without you, this research would not have been possible.

To Dr Debra Sayce and David Wood at CEWA, who initially planted the seed and gave me the gentle nudge to commence my doctorate: I thank you for your encouragement and support. To Miranda Swann and Jo Paini, for your unwavering professional and personal support, especially during the difficult times: Your wisdom, empathy, encouragement, and belief in me are extraordinary and never fail to

strengthen my resolve. I thank my wonderful colleagues, both those within the office of CEWA and my fellow principals and educators who showed interest in my studies, provided support in various ways, and cheered me along this journey. I feel privileged to work alongside you all.

I am blessed to be supported by family and friends who encouraged and supported me throughout this journey. In particular, thank you to my mother, Patsy, and my father, Kevin, who have always been selfless, steadfast, and unwavering in their love and support. Thank you for always being so proud of my achievements.

Finally, and most importantly, I extend my deepest thanks to my loving husband, David, for encouraging and supporting me from the very beginning. How blessed I am to have you. Thank you for always believing in me.

ABSTRACT

The importance of the classroom environment as the context in which learning takes place, as well as the impact of that environment on student outcomes, has been recognised through decades of learning environments research. An emergent element within contemporary classroom environments is technology, which educators strive to integrate into learning. Whereas much research has been conducted into learning environments at the secondary and tertiary education levels, little research has examined the perceptions of primary school students. In light of this, the present study examined the relationships between primary school students' perceptions of their learning environment; their use of Information and Communication Technology (ICT); and the affective outcomes of self-efficacy, enjoyment of class, and enjoyment of using ICT.

Driven by the lack of suitable instruments for use at the primary school level, three surveys were developed: one to assess primary school students' perceptions of their learning environment; one to assess primary school students' perceptions of their use of ICT within the classroom; and one to measure primary school students' self-reports of self-efficacy, enjoyment of class, and enjoyment of using ICT.

Following the development and pilot testing of the three surveys, they were administered, online, to a sample of 574 students within 31 year 4, 5, and 6 classes from 12 Catholic schools in Western Australia. The results provided evidence to support the factor structure, internal consistency reliability, discriminant validity, concurrent validity, and predictive validity of all three surveys.

To examine differences in students' perceptions of the actual classroom environment and the one that they would prefer, a one-way multivariate analysis of variance (MANOVA) was performed for both learning environment scales and ICT scales. For the learning environment scales (Student Cohesiveness, Teacher Support, Equity, Task Clarity, Responsibility for Learning, Involvement, Task Orientation, Personal Relevance, and Collaboration), the multivariate test yielded statistically significant results ($p < .01$) in terms of Wilks' Lambda criterion (Wilks, 1935), therefore, the univariate ANOVA was interpreted for each individual survey scale. The results

indicated that statistically significant ($p < .01$) differences existed between the actual and preferred scores for all nine scales. For all but one scale (Task Orientation), the results suggested that students would prefer a more positive learning environment than they currently perceived to be present. With the exception of two scales, the differences for all scales had effect sizes that were greater than 0.40 (ranging between 0.45 and 0.65 standard deviations).

The results of a one-way MANOVA, conducted for the two scales that used the actual–preferred response format (Investigating with ICT and Communicating with ICT), revealed statistically significant ($p < .01$) actual–preferred differences for both scales, suggesting that students would prefer more frequent use of ICT than they currently perceived. The corresponding effect sizes were 0.53 standard deviations for the Investigating with ICT scale and 0.70 standard deviations for the Communicating with ICT scale.

To investigate whether students' perceptions of the learning environment and their perceptions of their ICT use impacted on their self-reports of self-efficacy, enjoyment of class, and enjoyment of using ICT, simple correlation and multiple regression analyses were used. For the learning environment perceptions, the results of the simple correlation analysis indicated that there were statistically significant and positive relationships between all nine learning environment scales and the outcome scales (self-efficacy, enjoyment of class, and enjoyment of using ICT). Examination of the standardised regression coefficients (β) indicated that five of the nine learning environment scales were statistically significant independent predictors of students' self-efficacy: Student Cohesiveness ($p < .01$), Task Clarity ($p < .01$), Involvement ($p < .01$), Task Orientation ($p < .01$), and Collaboration ($p < .05$). Three of the nine learning environment scales were statistically significantly ($p < .01$) and positively related to students' enjoyment of class: Teacher Support, Personal Relevance, and Collaboration. Finally, three learning environment scales were statistically significantly and positively related to students' enjoyment of using ICT: Task Orientation ($p < .05$), Personal Relevance ($p < .01$), and Collaboration ($p < .05$).

For students' perceptions of ICT use, the results indicated that there were statistically significant and positive relationships between all five ICT scales (Investigating with

ICT, Communicating with ICT, Applying Social and Ethical Protocols and Practices, Managing and Operating ICT Effectively, and Changing Trends) and three affective outcomes (self-efficacy, enjoyment of class, and enjoyment of using ICT). Examination of the standardised regression coefficients (β) indicated that one ICT scale, Changing Trends, was statistically significantly ($p < .05$) and positively related to students' self-efficacy. Two scales, Investigating with ICT ($p < .01$) and Applying Social and Ethical Protocols and Practices ($p < .05$), were statistically significantly and positively related to students' enjoyment of class. Finally, two scales, Investigating with ICT and Changing Trends, were statistically significantly ($p < .01$) and positively related to students' enjoyment of using ICT.

To examine the differences between the responses of male and female students, a one-way MANOVA was used. In terms of the learning environment, the results suggested that the differences between the scores of male and female students were statistically significant for five scales: Teacher Support ($p < .05$), Equity ($p < .05$), Task Clarity ($p < .05$), Responsibility for Learning ($p < .05$), and Task Orientation ($p < .01$). For all but one of the scales, females perceived their learning environment more positively than males did. In relation to the use of ICT, the difference between the male and female students' scores was statistically significant for only one scale, Communicating with ICT ($p < .01$), with females reporting more frequent use of ICT to communicate than males. In terms of the affective student outcomes, the results of the MANOVA indicated that the difference between the male and female students' scores was statistically significant for only one scale: Self-Efficacy ($p < .01$).

A one-way MANOVA was similarly used to examine the differences between the responses of students who were considered to be at risk of academic failure and those who were not. For all scales on all three surveys, the scores reported by academically at-risk students¹ were lower than those reported by students who were not at risk.

The research reported in this thesis is significant for a number of reasons. First, it makes available three new, valid, and reliable instruments suitable for use in primary schools to measure students' perceptions of their learning environment, their use of

¹ Further information regarding the criteria for a child being considered at-risk can be found in Section 3.4.4 of Chapter 3.

ICT in the classroom, and the associated outcomes of self-efficacy, enjoyment of class, and enjoyment of using ICT. Second, the research reported in this thesis provides teachers, school and system leaders with valuable information about students' perceptions in relation to their learning environment; their use of ICT; and their self-reports of self-efficacy, enjoyment of class, and enjoyment of using ICT. Finally, the results of the present study contribute to learning environments research in terms of gender perceptions and extend past research by providing insights into the perceptions of academically at-risk students.

TABLE OF CONTENTS

| | |
|---|------|
| Declaration | i |
| Acknowledgements | ii |
| Abstract | iv |
| Table of Contents | viii |
| List of Tables..... | xi |
| List of Figures | xiv |
| Chapter 1 Introduction..... | 1 |
| 1.1 Context of the Study | 2 |
| 1.2 Background to the Study..... | 5 |
| 1.3 Theoretical Framework..... | 8 |
| 1.4 Research Objectives..... | 10 |
| 1.5 Significance of the Research..... | 16 |
| 1.6 Thesis Overview | 19 |
| Chapter 2 Review of Literature | 21 |
| 2.1 Introduction..... | 21 |
| 2.2 Learning Environments Research | 21 |
| 2.3 Using ICT to Enhance Learning | 43 |
| 2.4 Student Self-Efficacy and Enjoyment..... | 54 |
| 2.5 Gender Differences | 67 |
| 2.6 At-Risk Students | 74 |
| 2.7 Chapter Summary | 77 |
| Chapter 3 Research Design and Methods..... | 80 |
| 3.1 Introduction..... | 80 |
| 3.2 Research Objectives..... | 80 |
| 3.3 Use of Perceptual Measures: Rationale | 82 |
| 3.4 Sample | 84 |

| | | |
|-----------|--|-----|
| 3.5 | Instruments used for Data Collection | 91 |
| 3.6 | Data Analysis | 101 |
| 3.7 | Ethical Considerations | 107 |
| 3.8 | Chapter Summary | 110 |
| Chapter 4 | Analysis and Results: Reliability and Validity of the Research | 114 |
| 4.1 | Introduction..... | 114 |
| 4.2 | Validation of the Classroom Climate Questionnaire—Primary (CCQ-P)..... | 115 |
| 4.3 | Validation of the Information and Communication Technology (ICT) Usage Survey | 138 |
| 4.4 | Validation of the Self-Efficacy and Enjoyment Questionnaire (SEEQ)..... | 154 |
| 4.5 | Chapter Summary | 164 |
| Chapter 5 | Analysis and Results: Determinants and Effects | 169 |
| 5.1 | Introduction..... | 169 |
| 5.2 | Differences between Actual and Preferred Learning Environment Perceptions..... | 169 |
| 5.3 | Associations between the Learning Environment and Student Outcomes | 174 |
| 5.4 | Associations between the Use of ICT and Student Outcomes..... | 177 |
| 5.5 | Gender Differences | 180 |
| 5.6 | Differences Between the Perceptions of At-Risk and Not-At-Risk Students..... | 187 |
| 5.7 | Chapter Summary | 195 |
| Chapter 6 | Discussion..... | 200 |
| 6.1 | Introduction..... | 200 |
| 6.2 | Summary and Discussion of the Findings | 201 |
| 6.3 | Educational Implications | 233 |

| | | |
|-----|---|-----|
| 6.4 | Limitations of the Study | 251 |
| 6.5 | Summary of Recommendations..... | 252 |
| 6.6 | Significance of the Study..... | 262 |
| 6.7 | Concluding Remarks..... | 265 |
| | References | 267 |
| | Appendix 1 Permission to reproduce information in Table 2.1 | 319 |
| | Appendix 2 Permission to reproduce Figure 2.1..... | 322 |
| | Appendix 3 Classroom Climate Questionnaire—Primary (CCQ–P)..... | 323 |
| | Appendix 4 ICT Usage Survey | 328 |
| | Appendix 5 Self-Efficacy and Enjoyment Questionnaire (SEEQ) Scales and Items | 333 |
| | Appendix 6 Permission to reproduce Figure 3.1..... | 335 |
| | Appendix 7 Curtin University Ethics Approval..... | 337 |
| | Appendix 8 Catholic Education Office of Western Australia Approval..... | 338 |
| | Appendix 9 Teacher Information Sheet and Consent Form | 339 |
| | Appendix 10 Parent Information Sheet and Consent Form | 341 |
| | Appendix 11 Student Information Sheet | 343 |

LIST OF TABLES

| | | |
|-------------|---|-----|
| Table 2.1. | Overview of six classroom environment instruments..... | 34 |
| Table 3.1. | Range of schools involved in the study | 86 |
| Table 3.2. | Breakdown of students in the sample according to gender and ability | 88 |
| Table 3.3. | Breakdown of at-risk students in the study sample based on gender and year level | 90 |
| Table 4.1. | Description and sample item for each scale of the CCQ-P..... | 117 |
| Table 4.2 | CCQ-P scale names and corresponding contextual cues used in the survey presented to students | 123 |
| Table 4.3. | Factor loadings, eigenvalues, and percentages of variance explained for the actual version of the CCQ-P..... | 129 |
| Table 4.4. | Factor loadings, eigenvalues, and percentages of variance explained for the preferred version of the CCQ-P | 131 |
| Table 4.5. | Internal consistency reliability (Cronbach's alpha coefficient) for the scales of the actual and preferred versions of the CCQ-P..... | 134 |
| Table 4.6. | Component correlation matrix for the scales of the actual and preferred versions of the CCQ-P | 136 |
| Table 4.7. | Ability to differentiate between classes (ANOVA results) for each scale of the CCQ-P (based on responses to the actual version) | 137 |
| Table 4.8. | Pearson correlations between Self-Efficacy and the scales of the CCQ-P..... | 138 |
| Table 4.9. | Description and sample item for each scale of the ICT Usage Survey | 140 |
| Table 4.10. | ICT Usage Survey scale names and corresponding contextual cues used in the survey presented to students | 147 |
| Table 4.11. | Factor loadings, eigenvalues, and percentages of variance explained for the actual version of the ICT Usage Survey..... | 150 |
| Table 4.12. | Internal consistency reliability (Cronbach's alpha coefficient) for the scales of the ICT Usage Survey | 151 |
| Table 4.13. | Component correlation matrix for the scales of the actual version of the ICT Usage Survey | 152 |
| Table 4.14. | Ability to differentiate between classes (ANOVA results) for each scale of the ICT Usage Survey (based on responses to the actual version) | 152 |

| | | |
|-------------|---|-----|
| Table 4.15. | Pearson correlations between Enjoyment of ICT and the scales of the ICT Usage Survey | 153 |
| Table 4.16. | Description and sample item for each scale of the SEEQ..... | 155 |
| Table 4.17. | Factor loadings, eigenvalues, and percentages of variance explained for the scales of the SEEQ | 161 |
| Table 4.18. | Internal consistency reliability (Cronbach's alpha coefficient) for the scales of the SEEQ..... | 162 |
| Table 4.19. | Component correlation matrix for the scales of the SEEQ..... | 162 |
| Table 4.20. | Ability to differentiate between classes (ANOVA results) for each scale of the SEEQ..... | 163 |
| Table 5.1. | Average item means, average item standard deviations, and differences between means (effect sizes and MANOVA results) for the actual and preferred responses to the CCQ-P..... | 171 |
| Table 5.2. | Average item means, average item standard deviations, and differences between means (effect size and MANOVA results) for the actual and preferred responses to the ICT Usage Survey..... | 174 |
| Table 5.3. | Simple correlation and multiple regression results for associations between the CCQ-P and SEEQ scales | 175 |
| Table 5.4. | Simple correlation and multiple regression results for associations between the ICT Usage Survey and SEEQ scales | 178 |
| Table 5.5. | Average item means, average item standard deviations, and differences between means (effect sizes and MANOVA results) for male and female students' responses to the CCQ-P..... | 182 |
| Table 5.6. | Average item means, average item standard deviations, and differences between means (effect sizes and MANOVA results) for male and female students' responses to the ICT Usage Survey | 184 |
| Table 5.7. | Average item means, average item standard deviations, and differences between means (effect sizes and MANOVA results) for male and female students' responses to the SEEQ..... | 186 |
| Table 5.8. | Average item means, average item standard deviations, and differences in means (effect sizes and MANOVA results) for not-at-risk students and at-risk students responses to the CCQ-P | 189 |
| Table 5.9. | Adjusted and unadjusted means and variability for preferred learning environment perceptions with actual learning environment perceptions | |

| | | |
|-------------|--|-----|
| | used as covariates | 191 |
| Table 5.10. | Differences between the preferred learning environment perceptions for not-at-risk students and at-risk students after adjustment for the corresponding actual scores | 191 |
| Table 5.11. | Average item means, average item standard deviations, and differences between means (effect sizes and MANOVA results) for not-at-risk students and at-risk students for the ICT Usage Survey | 192 |
| Table 5.12. | Average item means, average item standard deviations, and differences between means (effect sizes and MANOVA results) for not-at-risk students and at-risk students for the SEEQ | 194 |

LIST OF FIGURES

| | | |
|-------------|---|-----|
| Figure 2.1. | Organising elements of the Australian Curriculum ICT capability (ACARA, n.d.) | 47 |
| Figure 2.2. | Bandura's (1978) bidirectional three-way model of interactions | 55 |
| Figure 3.1 | Construct validity framework (Trochim & Donnelly, 2008)..... | 103 |
| Figure 4.1. | Side-by-side response format (actual and preferred perceptions) used in the CCQ-P..... | 122 |
| Figure 5.1. | Average item means for the actual and preferred responses to the CCQ-P..... | 172 |
| Figure 5.2. | Average item means for male and female students' responses to the CCQ-P..... | 183 |
| Figure 5.3. | Average item means for male and female responses to the ICT Usage Survey | 185 |
| Figure 5.4. | Average item means for male and female students' responses to the SEEQ..... | 186 |
| Figure 5.5. | Average item means for not-at-risk students and at-risk students for the CCQ-P..... | 190 |
| Figure 5.6. | Average item means for not-at-risk students and at-risk students for the actual version of the ICT Usage Survey | 193 |
| Figure 5.7. | Average item means for not-at-risk students and at-risk students for the SEEQ..... | 195 |

Chapter 1

INTRODUCTION

I've come to a frightening conclusion that I am the decisive element in a classroom. It's my personal approach that creates the climate. It's my daily mood that makes the weather. As a teacher, I have a tremendous power to make a child's life miserable or joyous. I can be a tool of torture or an instrument of inspiration. I can humiliate or humour, hurt or heal. In all situations, it is my response that decides whether a crisis will be escalated or de-escalated and a child humanised or dehumanised. (Ginott, 1971, p. 13²)

The importance of the classroom environment on the context in which learning occurs, as well as the impact of that environment on student achievement, has been recognised through decades of learning environments research. The learning environment encompasses not only physical environmental elements but the socioemotional elements or the classroom climate. As the quote above suggests, classroom climate is an element of the environment which is largely influenced by the teacher and can determine students' affective outcomes. An emergent physical element within the modern classroom environment is the use of technology to enhance student learning. As such, the present study aimed to examine the relationships between primary school students' perceptions of their learning environment; their use of ICT; and the affective outcomes of self-efficacy, enjoyment of class, and enjoyment of using ICT. The present study also sought to examine whether differences existed between students' perceptions according to gender and for students at risk of academic failure compared to those who are not considered to be at risk.

The purpose of this chapter is to provide an introduction to the research described in this thesis. This chapter is organised under the following headings:

- Context of the study (Section 1.1);
- Background to the study (Section 1.2);

² Ginott, H. G. (1971). *Teacher and child*. New York, NY: Macmillan.

- Theoretical framework (Section 1.3);
- Research objectives (Section 1.4);
- Research design and methods (Section 1.5)
- Significance of the research (Section 1.6); and
- Thesis overview (Section 1.7).

1.1 Context of the Study

This section provides information about the context in which this study was conducted. Specifically, this section describes the geographical location of Western Australia (Section 1.1.1); the education system in Western Australia (Section 1.1.2); and the integration of ICT in Western Australian primary schools (Section 1.1.3).

1.1.1 Geographical Location of Western Australia

The present study took place in Western Australia, the largest of Australia's six states and territories, consisting of over 2.5 million square kilometres and occupying approximately 33% of the nation's total land mass (Encyclopaedia Britannica, 2018). Most of the state is comprised of arid land. Western Australia is bordered by the Indian Ocean to the north and west and the Southern Ocean to the south. The Northern Territory lies to the north-east of Western Australia and the state of South Australia lies to the south-east.

Much of Western Australia is remote and sparsely populated, with a population of approximately 2.6 million people which accounts for approximately 10% of the nation's total population (Australia Bureau of Statistics, 2017). Approximately 79% of the state's population resides in the state capital city, Perth. Aboriginal and Torres Strait Islander peoples account for 3.1% of the Western Australian population; the five most common ancestries among the residents of the state are English, Australian, Irish, Scottish, and Italian (Encyclopaedia Britannica, 2018).

In terms of industry, Western Australia contributes over half of the nation's mineral and energy exports, the highest exports from the state being iron ore, petroleum, nickel, alumina, and gold. Western Australia's agricultural industry—which includes

the supply of wheat, barley, wool, lamb, and beef—is a major contributor to the state’s economy (Encyclopaedia Britannica, 2018).

1.1.2 Education in Western Australia

In Australia, although education funding is provided by both the federal and state governments, education is primarily the responsibility of the state governments. Three education sectors exist within Western Australia: the public-school sector, governed by the state government’s Department of Education; the independent school sector, governed by the Association of Independent Schools of Western Australia; and the Catholic school sector, governed by Catholic Education Western Australia (CEWA). The school sector of CEWA operates as the executive arm of the Catholic Education Commission of Western Australia (CECWA), with both CECWA and CEWA being accountable to the Catholic Bishops of Western Australia. The research involved in the present study took place within the Catholic education sector of Western Australia.

Across the public, independent, and Catholic sectors in Western Australia, education consists of a three-tiered system comprising of primary education (kindergarten, pre-primary and year 1 to year 6 schools), secondary education (year 7 to 12 schools and colleges), and tertiary education (universities and technical colleges). Education is compulsory in Western Australia between the ages of five (pre-primary) and 17 years. Many primary schools in Western Australia also offer pre-kindergarten for three-year-old children; however, together with kindergarten (for four-year-old children), these are non-compulsory years of schooling.

The present study was conducted at the primary education level. At the primary school level in Western Australia, the classroom teacher is responsible for delivering the curriculum in almost all learning areas, whereas, in secondary schools, individual teachers teach within specific subject areas. In primary schools, a limited number of specialist teachers (three to four) deliver the curriculum in discrete subjects such as physical education, languages other than English, and the arts.

The curriculum in Western Australia is based on the Australian Curriculum. This national curriculum was developed by the Australian Curriculum, Assessment and

Reporting Authority (ACARA) and was implemented in stages between 2011 and 2018. The Australian Curriculum is comprised of eight learning areas (English, mathematics, science, humanities and social sciences, the arts, technologies, health and physical education, and languages). In addition, seven general capabilities (literacy, numeracy, intercultural understanding, ethical understanding, personal and social capability, critical and creative thinking, and ICT) are designed to be integrated across the Australian Curriculum content. According to ACARA (n.d.), these general capabilities embody the skills, behaviours, knowledge, and dispositions that students require to become creative, self-assured, successful learners, and active and informed citizens in the twenty-first century. The School Curriculum and Standards Authority (of Western Australia) is the independent statutory body responsible for the adaptation of the national curriculum to suit the context of the state, thereby developing the Western Australia curriculum. The School Curriculum and Standards Authority is also responsible for developing achievement standards associated with the state curriculum (which apply across all school systems) and overseeing assessment and reporting according to those standards.

1.1.3 The Integration of ICT in Western Australian Primary Schools

In Western Australia (as in many other national and international contexts), an important and emergent element of contemporary classroom environments is the use of ICT. With the rapid advancement of technology development over recent decades (Aesaert & van Braak, 2014; Fullan, 2012), the omnipresence of ICT in global societies has led to technology becoming an indispensable part of the modern classroom and the ability to effectively use technology in a variety of settings being seen as a vital skill for full participation in a twenty-first century society (Aesaert & van Braak, 2014; Ahuja, 2016; Collins & Halverston, 2009; Duignan, 2012; Fraillon, Ainley, Schultz, Friedman, & Gebhardt, 2014; Fullan, 2012; Siddiq, Scherer, & Tondeur, 2016; Valtonen et al., 2015). The Australian Federal Government has acknowledged the importance of ICT in education by encouraging the development of technology-rich learning environments in all Australian classrooms (Jones, 2011). For example, this encouragement is reflected in the inclusion of technologies as one of the Australian Curriculum learning areas and the inclusion of ICT as one of the Australian Curriculum general capabilities, as described in the previous section (Section 1.1.2).

Increasingly, Australian schools and education systems have invested heavily in ICT hardware and infrastructure and teacher training (Chipangura, 2014; Jones, 2011).

The present study took place in Catholic schools in Western Australia, which are generally well resourced with a variety of technologies including desktop computers, iPads, laptops, Chromebooks, interactive whiteboards, digital projectors, and interactive television screens. Some Catholic schools have a one-to-one ratio of digital devices to students from year 4 upwards. Generally, classroom teachers in CEWA schools are provided with a digital device such as an iPad and or laptop for professional use.

This section (Section 1.1) has outlined the context in which the present study took place including the geographical location, the broad educational context, and the integration of ICT within the Catholic schools that were relevant for this research. The next section (Section 1.2) provides a background to the present study.

1.2 Background to the Study

This study examined the relationships between students' perceptions of the classroom environment, use of ICT in the classroom and the affective outcomes of self-efficacy and enjoyment (of class and use of ICT) at the primary school level. This section (Section 1.2) outlines the background to the inclusion of these themes within the present study.

It has been estimated that students spend up to 7,000 hours in classrooms by the end of their primary school education and 15,000 hours by the completion of secondary school (Fraser, 2001). As such, it is important for educators to ensure that the impact of the classroom environment on students is positive.

The importance of the learning environment as the context in which learning takes place has been widely recognised (Aldridge & Galos, 2017; Dumont & Instance, 2010; Dumont, Instance, & Benavides, 2010; Park, Stone, & Holloway, 2017; Tshewang, Chandra, & Yeh, 2017). Much past research has indicated that learning environments can have significant impacts on a range of student outcomes including: achievement

(Chionh & Fraser, 2009; Wolf & Fraser, 2008); self-efficacy (Al Zubaidi, Aldridge, & Khine, 2016; Chionh & Fraser, 2009; Dorman, 2001; Velayutham & Aldridge, 2013); enjoyment (Bell & Aldridge, 2014; Martin-Dunlop & Fraser, 2008; Ogbuehi & Fraser, 2007); and self-regulation (Velayutham & Aldridge, 2013). It is considered imperative, therefore, that the classroom climate—which encompasses aspects such as the tone, ambience, atmosphere, and relationships within the classroom—is positive and supportive, ensuring that the classroom context is a happy and comfortable space for students to be and learn within (Aldridge et al., 2016; Lerdpornkulrat, Koul, & Poondej, 2018; Persson & Svensson, 2017; Schenke, Ruzek, Lam, Karabenick, & Eccles, 2017). This imperative is recognised in the Australian Institute for Teaching and School Leadership (AITSL) teacher standards, which require teachers to create and maintain supportive and safe learning environments (AITSL, 2014).

Despite the recognised importance of the learning environment, in practice, much teacher attention has been found to be focused on assessing academic outcomes whereas little attention is focused on assessing the nature of the classroom climate or its impact on students (Earl, 2003; Fraser, 2001; Fullan, 2011; Timperley, 2011; Tshewang et al., 2017). Learning environment surveys provide educators with the means to assess the important effects of the classroom climate on student academic and affective outcomes using the perceptions of the students themselves. Walberg and Haertel (1980) argue that students are capable of providing valid judgements about their learning environment, and numerous researchers have advocated the use of student perceptual measures to assess the learning environment (Aldridge, Afari, & Fraser, 2012; Aldridge, Fraser, Bell, & Dorman, 2012; Earl, 2003; Fraser, 1982, 2001, 2012c; Fullan, 2011; Moos, 1973; Schneider & Stern, 2010; Schunk, 1992; Timperley, 2011; Wahlberg, 1979). According to den Brok, Fisher, Rickards, and Bull (2006), strong relationships exist between students' perceptions of the classroom environment and students' academic achievement and affective outcomes (such as self-efficacy and enjoyment). This view is supported by numerous studies that suggest that student outcomes are likely to be enhanced when students have positive perceptions about their learning environment (Chipangura & Aldridge, 2017; Dorman, 2003; Dorman & Fraser, 2009; Eccles & Wigfield, 2002; Fraser, 2012c; Soebari & Aldridge, 2015, 2016; Velayutham & Aldridge, 2013). As such, research in the field of learning environments research has utilised student perceptual measures as the dominant source

of data for nearly five decades (see, for example, Aldridge, Afari, et al., 2012; Aldridge, Fraser, et al., 2012; Aldridge & Fraser, 2008; Aldridge, Fraser, & Sebela, 2004; Aldridge, McChesney, & Afari, in press; Bell & Aldridge, 2014; Fraser & Fisher, 1983a; Sinclair & Fraser, 2002; Yarrow, 1997).

Although a large body of research exists in the learning environments field, the majority of this work has been conducted in secondary and tertiary educational settings, and few instruments exist for use at the primary school level (Aldridge, Fraser, & Ntuli, 2009; Aldridge, Fraser, et al., 2012; Aldridge, Fraser & Huang, 1999; Aldridge & Fraser, 2011; Aldridge & Galos, 2017). The impetus for the research reported in this thesis, therefore, was to fill a gap in existing research by developing new learning environment surveys that would be suitable for use in primary school classroom contexts to examine students' perceptions of their classroom climate as well as the impact of these perceptions on affective student outcomes.

Given that ICT has become an integral part of contemporary learning environments, students' perceptions about its use should not be ignored, and ongoing research is required to ensure that ICT is used effectively in the classroom (Fraser, 2003; Koul, Fisher, & Shaw, 2011). Currently, however, little research into students' perceptions of ICT use in the classroom exists (Chipangura & Aldridge, 2017). The impetus for the present study, therefore, included a desire to investigate students' perceptions of the integration of technology into the learning environment and, further, to examine the effect of this ICT integration on affective student outcomes. The present study aimed to extend the field of learning environments research in terms of examining the impact of technology integration in the classroom.

This section (Section 1.2) provided a background to the present study, showing how considerations related to the learning environment, use of ICT in the classroom and the subsequent impact on student perceptions and affective outcomes provided motivations for the research described in this thesis. With this background established, the following section (Section 1.3) outlines the theoretical framework which underpinned the research reported in this thesis.

1.3 Theoretical Framework

Any approach to research involves the intersection of specific methods and philosophical assumptions (Creswell, 2014). Philosophical assumptions can be described as the set of beliefs, paradigms, frameworks, or epistemologies and ontologies that guide research and inquiry and that then inform the methods of research that are used to translate the research approach into practice (Creswell, 2014). Acknowledging these philosophical assumptions enhances the validity of research by permitting the assumptions, methods, and conclusions related to a given study to be scrutinised and critiqued (Maxwell, 2009). This section, therefore, identifies the research philosophy or framework that underpinned the present study and highlights how key features of this framework were reflected in the study.

The present study was situated within a post-positivist framework. Post-positivism builds on positivism, which is a traditional approach that is used as a basis for research in the social sciences that seeks to examine human social experiences (Hasan, 2016). However, positivism has been criticised as being an unsuitable basis for investigating the rich complexities of social contexts, based on the notion (not reflected in a positivist perspective) that human actions can hold multiple meanings (Hasan, 2016). Post-positivism, in contrast, recognises that knowledge is socially constructed (Henderson, 2011) and that we cannot be entirely positive about our conclusions when examining the behaviours of human beings, thus prompting reflection on the various causes that influence outcomes (Creswell, 2014). The origins of post-positivism stem from 19th-century writers such as Comte and Durkheim (Creswell, 2014; Hasan, 2016) and from more recent theorists such as Phillips and Burbules (2000). Such post-positivist theorists hold a reductionist view that advocates reducing ideas into small, discrete sets that can be tested (such as the variables that comprise research objectives) and the development of numeric measures of behavioural observations (Creswell, 2014). Stewart and Floyd (2004) recognised a need for post-positivism in social science research as a means of better representing people's lived experiences than a traditional positivist approach. A post-positivist approach was selected to underpin the present study as, according to Henderson (2011), post-positivism allows researchers to uncover meanings about people's multiple interpretations of reality through the use of situational data gathered in natural settings, thus enabling solutions to be found for

important problems. These aspects of post-positivism relate the present study which seeks to uncover students' multiple interpretations of reality gathered in a natural classroom setting, thus enabling teachers to enhance the learning environment according to the perceptions and needs of their students.

The present study was aligned with several post-positivist research principles as outlined by Creswell (2014). First, Creswell notes that a post-positivist viewpoint includes an assumption that data, evidence, and rational considerations shape knowledge; he further notes that, given this foundation, post-positivist research involves the use of instruments to collect information in the form of measures that are completed by the research participants or observations that are completed by the researcher. These aspects of the post-positivist theoretical approach aligned well with the present study: The study drew on information provided by the research participants in the form of student surveys about their perceptions of the learning environment, use of ICT and their self-reports of affective outcomes (self-efficacy, enjoyment of class, and enjoyment of using ICT).

Second, Creswell (2014) notes that post-positivist research seeks to describe associations or causal relationships. This approach was reflected in the present study, which sought to examine the relationships between students' perceptions of their learning environment, use of ICT, and affective outcomes.

Third, Creswell (2014) argues that essential elements of post-positivist studies are objectivity and the elimination of bias (for example, through establishing standards of validity and reliability). Reflecting these requirements, the present study drew on Trochim and Donnelly's (2008) content validity framework to gather evidence to support the reliability and validity of the three newly developed surveys.

Fourth, post-positivism supports the use of quantitative research as a way of examining and understanding the meaning that groups or individuals attribute to a social problem (Creswell, 2014). The data in post-positivist quantitative research are typically collected in the participants' settings, analysed inductively, and used to generate interpretations of the meaning of the data (Creswell, 2014). In terms of the present study, the development and implementation of quantitative surveys to gather

student perceptual data within their typical learning setting aligns with these aspects of the post-positivist theoretical framework.

This section (Section 1.3) has described the theoretical framework that underpinned the research described in this thesis. The following section (Section 1.4) outlines the research objectives of the study.

1.4 Research Objectives

Given the lack of existing research into learning environments within primary school settings, the present study was framed by two overarching aims. First, the study sought to examine the relationships between primary school students' perceptions of their learning environment and the affective student outcomes of self-efficacy, enjoyment of class, and enjoyment of using ICT in the classroom. Second, the study aimed to assess the relationships that existed between primary school students' perceptions of the use of ICT within their learning environment and their affective outcomes (self-efficacy, enjoyment of class, and enjoyment of using ICT). To support these overarching aims, six specific research objectives were identified; these objectives are outlined in this section.

Due to the lack of available learning environment instruments suitable for use in primary school settings, for the purposes of the present study, it was necessary to develop, administer, and validate three new surveys for use in primary school classrooms. One instrument was developed to assess students' perceptions of the learning environment, one to assess students' technology use in the classroom, and one to assess affective student outcomes. As a result, the first research objective was:

Research Objective 1

To develop and validate three surveys to assess primary school students’:

- a) Perceptions of the learning environment;
- b) Use of ICT; and
- c) Outcomes in terms of:
 - i. Self-efficacy;
 - ii. Enjoyment of their class; and
 - iii. Enjoyment of using ICT.

Past research suggests that students prefer a learning environment that is more favourable than the one that they perceive to be actually present (Aldridge et al., 2009; Aldridge, Dorman, & Fraser, 2004; Aldridge, Fraser, et al., 2012; Dorman, 2008a, 2008b; Henderson, Fisher, & Fraser, 2000; Koul et al., 2011; Lai et al., 2015; Magen-Nagar & Steinberger, 2017; Rekha, Fisher, & Shaw, 2011; Rita & Martin-Dunlop, 2011; Wong et al., 2006). The present study extended past research by examining the differences between the actual and preferred perceptions of primary school students not only in relation to their learning environment but also in relation to their use of ICT within the classroom. As such, the second research objective was:

Research Objective 2

To examine the actual–preferred differences reported by primary school students in terms of their:

- a) Perceptions of the learning environment; and
- b) Use of ICT.

According to Fraser (1982), students’ perceptions of their learning environment can strongly influence their behaviour. Numerous studies suggest that strong links exist between the learning environment and important affective student outcomes such as self-efficacy and enjoyment (see, for example, Fraser, 2001; Fullan, 2012; Wubbels,

1993). Such affective outcomes can subsequently impact on students' academic achievement (Aldridge, Afari, et al., 2012; Aldridge & Fraser, 2008; Boz, Yerdelen-Damar, Aydemir, & Aydemir, 2016; Phan & Ngu, 2014). The present study extended this field of research by examining the relationships between students' perceptions of their learning environment and their affective outcomes at a primary school level. To this end, the third research objective was:

Research Objective 3

To examine the relationships between primary school students' perceptions of the learning environment and their self-reports of:

- a) Self-efficacy;
- b) Enjoyment of their class; and
- c) Enjoyment of using ICT.

Research suggests that the use of ICT in the learning environment can impact positively on students' self-efficacy (Aesaert & van Braak, 2014; Koul et al., 2011; Tomte & Hatlevik, 2011) and enjoyment (Koul et al., 2011; Ozdemir, 2015). The present study extended this research by examining the relationships between students' perceptions of ICT use and student affective outcomes at a primary school level. To this end, the fourth research objective was:

Research Objective 4

To examine the relationships between primary school students' perceptions of their use of ICT and their self-reports of:

- a) Self-efficacy;
- b) Enjoyment of their class; and
- c) Enjoyment of using ICT.

On a daily basis, educators strive to cater to the academic, social, physical, and emotional needs of individual students within the classroom environment. The perceptions of different groups of students in relation to their learning environment have the potential to provide teachers with vital information that can help the teachers cater to students' differing needs (for example, according to gender). Therefore, the fifth research objective for the present study was:

Research Objective 5

To examine whether learning environment perceptions and outcomes (in terms of self-efficacy and enjoyment) differ for primary school students of different genders.

Given students' differing academic abilities, teachers also strive to cater to the individual needs of students who find learning difficult. Without tailored support and intervention, these students are at risk of not achieving appropriate outcomes for their age group, such as national minimum standards. The perceptions of students who are considered to be at risk have the potential to provide teachers with vital information that can help the teachers cater for these students' needs, which may be different to the needs of students who are not considered to be at risk. Therefore, the sixth and final research objective was:

Research Objective 6

To examine whether learning environment perceptions and outcomes (in terms of self-efficacy and enjoyment) differ for primary school students who are at risk compared to those who are not at risk.

This section (Section 1.4) has outlined the objectives of the present study. The following section (Section 1.6) discusses the research design and method of the present study.

1.5 Research Design and Methods

This section (Section 1.5) has outlined the research design and methods of the present study. The following section (Section 1.6) discusses the significance of this research.

The research design and methods used to collect and analyse data for the present study involved the development and administration of three online student surveys to gather feedback about the learning environment, use of ICT, and student self-efficacy and enjoyment (of both their class and their use of ICT).

The sample was purposively selected to ensure a representative range of schools, teachers, and classes between years 4 and 6. Twelve coeducational Catholic schools were involved in the study and 31 teachers participated with 30 year 4, 5 or 6 classes (with one teacher administering the questionnaires to two classes).

A total of 609 students responded to the three questionnaires with a minimum of three at-risk students in each class. Questionnaires were administered to students who (a) did not have a diagnosed learning disability; (b) had provided their verbal consent; and (c) had written parent consent to participate. Given that administration of each questionnaire was conducted on two separate days, only data from students that were present on both days was used, providing a matched sample of 574 students. Of these students, 158 were in year 4, 252 were in year 5 and 164 were in year 6. Of the 574 students, 283 were male and 291 were female.

Three instruments were developed and validated for the purposes of this study; the Classroom Climate Questionnaire—Primary (to gather information about the learning environment from the students' perspective), the ICT Usage Survey (to assess students' use of ICT in the classroom) and the Self-Efficacy and Enjoyment Questionnaire (to assess three student outcomes of self-efficacy, enjoyment of class, and enjoyment of using ICT). The development of the three surveys involved six steps: (a) a review of related literature; (b) the selection and development of relevant scales; (c) the modification and development of survey items; (d) the selection of the response format; (e) a review by an expert panel; and (f) the pilot testing of the survey instruments.

The data collected from the sample of 574 students were analysed to address each of the research objectives of the present study. To address research objective 1, the examination of the construct validity of each instrument was guided by Trochim and Donnelly's (2008) construct validity framework which helped to ensure that the content of the questionnaires was appropriate for the overall purpose of each instrument. To provide evidence to support the criterion validity of the surveys in terms of convergent, discriminant, concurrent, and predictive validity, various analyses were carried out. Factor structure and scale reliability were examined separately for each instrument. An intercorrelation matrix generated during oblique rotation was used to provide evidence to support the discriminant validity between scales. An ANOVA was calculated for each scale to ensure concurrent validity. Finally, simple correlation was used to provide evidence to support the predictive validity of each instrument.

To address research objective 2, the differences between students' actual and preferred perceptions of their classroom environment and the extent of ICT usage within the classroom were examined. Average item mean and average item standard deviation differences were calculated, MANOVAs were used to examine whether the differences were statistically significant, and effect sizes were calculated to examine the magnitude of the differences.

To investigate research objectives 3 and 4, the relationships among aspects of the learning environment, ICT usage, and the outcomes of student self-efficacy, enjoyment of class and enjoyment of using ICT) were examined using simple correlation and multiple regression analyses.

Research objective 5 examined whether differences existed in the learning environment perceptions and outcomes (self-efficacy, enjoyment of class, and enjoyment of using ICT) according to gender and research objective 6 sought to examine whether differences existed for students who were academically at risk and those students who were not at risk. To examine perceptual differences in these groups of students, MANOVA was used. Effect sizes were calculated to examine the magnitude of the differences between means (expressed as standard deviations), and the univariate one-way ANOVA was interpreted for each scale. Given that at-risk and

not at-risk students reported different experiences of the classroom environment, an ANCOVA was used to examine the differences in the learning environment preferences.

Throughout the study, considerations were made and procedures were put in place to ensure that the research was carried out in an ethical manne, including uded ensuring that appropriate permissions and consents were obtained from CEWA, school principals, teachers, and parents. Student information sheets were provided and explained verbally to students to ensure that they were aware of their right to withdraw from the study at any time. Verbal consent was obtained from each student. Individual student results were kept confidential and were not made available to teachers. Individual class data confidentiality was maintained as class level data was revealed only to the class teacher and was not made available to principals. Data from the present study has been stored securely.

1.6 Significance of the Research

The significance of the present study is outlined briefly below and elaborated on in Section 6.6 of Chapter 6. The present research is of methodological, theoretical, and practical significance to the field of learning environments research.

The present study is methodologically significant due to the development and validation of three new instruments to measure student perceptions in key areas. First, a new instrument was developed and validated to measure students' perceptions of their learning environment (including actual-preferred differences) at the primary school level. Second, an instrument was developed and validated to assess students' perceptions of the use of ICT within the primary school classroom environment. Third, an instrument was developed and validated to measure primary school students' self-reports of three affective outcomes: self-efficacy, enjoyment of class, and enjoyment of using ICT. In all three cases, few instruments exist that are suitable for use at a primary school level, and to the best of the researcher's knowledge, no other instruments exist that measure primary school students' perceptions of ICT use in the classroom, particularly in relation to the ICT general capability of the Australian Curriculum (ACARA, n.d.). The three new instruments provide economical and

efficient means for primary school educators to assess students' perceptions of their learning environment, their use of ICT, and the impact of these environmental factors on students' self-reports of self-efficacy and enjoyment (both of class and of the use of ICT). This data can be used with a view to enhance the learning environment, the use of ICT, and, ultimately, affective student outcomes.

In terms of its theoretical contribution, the present study contributes to and extends past literature in several ways. First, this study serves to bridge the research gap in terms of examining primary school students' perceptions about their learning environment and how these perceptions impact on students' self-efficacy and enjoyment (of class and ICT use). To date, learning environments research has predominantly focused on the perceptions of secondary and tertiary education students, and few studies have been conducted at the primary school level. Given that the respondents in the present study were in school years 4, 5, and 6, the findings of the present research contribute to learning environments literature in relation to primary school settings.

Second, the findings of this study contribute to and extend past literature related to students' perceptions of ICT use in primary school classrooms and the impact of these perceptions on students' self-efficacy and enjoyment (of class and use of ICT). The majority of previous studies of school-based ICT use have focused on secondary and tertiary students' perceptions, whereas the findings of the present study offer potentially important insights into the perceptions of primary school students in relation to ICT use and its impact on affective outcomes (self-efficacy and enjoyment). This contribution to research is also distinctive as it provides Australian primary educators with data that specifically document students' perceptions related to the implementation of the ICT general capability from the Australian Curriculum within the classroom.

Third, the results of this study contribute to learning environments research by providing insight into differences in key groups of primary school students' perceptions related to their learning environments, ICT use, and affective outcomes (self-efficacy, enjoyment of class, and enjoyment of ICT). Specifically, this research examined the differing perceptions of male and female students as well as those of

students who are considered to be academically at risk and not at risk. In terms of gender, the results of the present study add to the existing body of research that has examined differences between male and female students' perceptions of the learning environment, and also serve to fill the gap that remains in relation to the nature of these perception differences for primary school-aged students. The findings of this study also make a unique contribution to the field of learning environments research by comparing the learning environment perceptions of academically at-risk students with those of students who are not considered to be at risk.

In practical terms, the present study offers potentially important insights for Australian primary school educators in relation to students' perceptions of their learning environments and their use of ICT as well as how these perceptions impact on students' self-efficacy, enjoyment of class, and enjoyment of using ICT. Teachers could utilise the findings of this study to make adjustments to their practice and to aspects of their classroom environments in order to bridge the gap between students' actual-preferred perceptions, thus enhancing both the learning environment and student outcomes. The findings of this study also offer teachers practical insights into the differences in students' perceptions and outcomes according to gender and academic risk status. Educators can utilise these findings to make adjustments to their classroom environments and their teaching practice in order to ensure that the differing needs of these groups of students are adequately catered for.

Overall, the findings of the present study provide practical insights for primary school educators about how they can foster effective classroom environments (which include the integration of technology) that positively impact students' self-efficacy, enjoyment of class, and enjoyment of using ICT. The results of this study may, therefore, be informative for teachers as well as school and system leaders in relation to creating positive classroom environments, integrating ICT into classroom teaching, supporting student self-efficacy and enjoyment, promoting gender equity, and catering for academically at-risk students.

This section (Section 1.6) has outlined the significance of this study and the methodological, theoretical, and practical contributions it offers (which are discussed further in Section 6.6 of Chapter 6). The next section (Section 1.7) concludes this

introductory chapter by providing an overview of the organisation of the remainder of this thesis.

1.7 Thesis Overview

The research that forms the basis of this thesis is reported in six chapters. This chapter has introduced the thesis, providing contextual information and background related to the study. This chapter has also outlined the theoretical framework and the research objectives and briefly summarised the significance of the study.

Chapter 2 presents a review of literature in four key areas pertinent to the present study. First, given that this study drew on and extended the field of learning environments research, Chapter 2 provides a brief summary of the history of this field. Within this chapter, existing learning environments survey instruments are also reviewed. Second, given that the present study included a focus on the classroom integration of ICT, Chapter 2 examines literature on the use of ICT to enhance learning. Third, given that the present study examined how the learning environment and use of ICT affect students' self-reports of self-efficacy, enjoyment of class, and enjoyment of using ICT, Chapter 2 reviews literature related to these affective outcomes. Finally, given that the present study assessed the differences in the perceptions of male and female students and between academically at-risk students and those who are not at risk, Chapter 2 reviews research related to gender perception differences and at-risk students.

Chapter 3 describes the quantitative research methods used in this study. The research objectives are restated, and a rationale is provided for the use of student perceptual measures. A description of the research participants is provided, and sampling and selection procedures are outlined including the selection of schools, classes, and students together with the procedure for identifying academically at-risk students. Chapter 3 also outlines the steps taken to develop the new instruments for the purposes of the present study, then briefly describes these surveys and the associated data collection process. Chapter 3 then provides details of the data analyses that were used to address the research objectives of the study. A summary of the ethical considerations associated with the research concludes Chapter 3.

Chapter 4 reports the data analysis and results related to the first research objective, which sought to provide support for the validity and reliability of the three newly developed instruments for use in the present study. The process used to gather evidence to support the construct validity of the three surveys is outlined in Chapter Four, first, according to translation validity (in terms of content and face validity) and second, according to criterion validity (in terms of convergent, discriminant, concurrent, and predictive validity).

In Chapter 5, the results of the analyses used to address research objectives 2 to 6 are reported. First, actual–preferred differences are examined to compare students’ preferences and their actual perceptions in terms of both their learning environment and their use of ICT (research objective 2). Second, environment–outcome associations are examined to elucidate the relationships between students’ perceptions of the learning environment and their self-reports of self-efficacy, enjoyment of class, and enjoyment of using ICT (research objective 3). Third, ICT usage–outcome associations are examined to elucidate the relationships between students’ perceptions of ICT use in the classroom and their self-reports of self-efficacy, enjoyment of class, and enjoyment of ICT (research objective 4). Fourth, results of all three surveys are analysed to examine whether male and female students differed in terms of their perceptions of their learning environment; their use of ICT; and their self-efficacy, enjoyment of class, and enjoyment of using ICT (research objective 5). Finally, the perceptions of academically at-risk and not-at-risk students are compared to examine differences in these students’ perceptions of their learning environment; their use of ICT; and their self-efficacy, enjoyment of class, and enjoyment of using ICT (research objective 6).

Chapter 6 concludes this thesis by providing a summary of the results and a discussion of the findings related to each of the six research objectives as well the educational implications of these findings. The limitations of the study are presented along with a discussion on how these limitations might be addressed in future studies. A summary of the recommendations made within the thesis is then provided, and the significance of the study is discussed in further detail. These sections are followed by concluding remarks.

REVIEW OF LITERATURE

2.1 Introduction

This chapter provides a review of the literature related to the present study. First, given that this study drew on and extended past work in the field of learning environments, this review of literature summarises past research in this field (Section 2.2). Second, as the research undertaken in this study focused on the integration of ICT into classrooms in order to enhance learning, literature related to the integration of ICT and its impact on student learning is examined (Section 2.3). Third, to inform the inclusion of the student outcomes within the present study, previous research in the areas of student self-efficacy and enjoyment is reviewed (Section 2.4). Fourth, given that the present study compared the differing perceptions of male and female students, research related to gender differences is reviewed (Section 2.5). Finally, research related to at-risk students is reviewed as these students were of particular focus in this study (Section 2.6).

2.2 Learning Environments Research

The term *learning environment* encompasses the physical, pedagogical, social, psychological context in which learning takes place and which, in turn, affects student attitudes and achievement (Fraser, 2012a). For the purposes of this review, the term learning environment was considered to include both the physical and psychosocial environment such as student–student and student–teacher relationships at the classroom level. Collectively, these psychosocial elements could also be described as the classroom climate. To inform the development of a new learning environment to examine students’ perceptions of their learning environment in the primary school setting, research in the field of learning environments was reviewed (research objective 1).

By the completion of primary school, students will have spent around 7000 hours in the classroom setting; as such, students’ perceptions of their educational experiences

provide important feedback for educators (Fraser, 2001). Fraser (2012c) argues that the classroom environment influences student outcomes so strongly that it should not be overlooked when aiming to enhance school effectiveness. A positive learning environment is central to student learning as learning environments have strong links to a range of important affective outcomes, including motivation, engagement, self-efficacy, and enjoyment (Fraser, 2001; Fullan, 2012; Wubbels, 1993). Boekaerts (2010, p. 105) stated that “students are more motivated to engage in learning and use motivation regulation strategies when they perceive the environment as favourable for learning.”

How students perceive and react to their school experience is significant (Fraser, 1989), particularly as student perceptions are determinants of student behaviour and a range of other student outcomes (Fraser, 1982). Therefore, students’ experiences within the classroom setting—such as their interactions with teachers and peers and the nature of the teaching and learning that occur—are important.

Despite past research suggesting that students are able to provide valid judgments about psychosocial characteristics of their learning environment (Bell & Aldridge, 2014; Fraser, 1998a, 2007, 2012c; Nelson, Ysseldyke, & Christ, 2015; Walberg & Haertel, 1980), there continues to be an emphasis in schools on using academic test results as the primary means of feedback (Earl, 2003; Fraser, 2001, 2012c; Fullan, 2011; Timperley, 2011; Tshewang et al., 2017). At the primary school level, this emphasis may be due to a lack of validated instruments. An important feature of the present study, therefore, is the use of student perceptions of the learning environment as a complementary data source alongside academic test results.

Given the demonstrated importance of learning environments and students’ perceptions of these environments, as well as the limited school-based attention given to these perceptions to date, an important feature of the present study was the use of student perceptions of the learning environment as a data source. To inform this effort, the remainder of this section reviews literature in the field of learning environments under the following headings:

- The establishment of the field of learning environments research (Section 2.2.1);
- Past learning environment research (Section 2.2.2); and
- The need for a new learning environment instrument (Section 2.2.3).

2.2.1 The Establishment of the Field of Learning Environments Research

This section outlines the seminal works that formed the beginning of learning environment research. These studies established the first learning environment surveys on which more modern instruments are based, including the surveys developed for the purposes of the present study. This section is complemented by Section 2.2.2, which reviews more modern work in the field of learning environments.

The foundation for the subsequent development of the field of learning environments research included work by Lewin (1936) and Murray (1938). Lewin (1936) drew on the field of psychology to develop the initial studies applicable to the field of learning environments. His seminal work on field theory (Lewin, 1936) moved from the traditional focus (within psychological studies) on the individual to a focus on the interactions between individuals (see also Crosbie-Brunett & Lewis, 1993). Lewin's (1936) work acknowledged that the environment and its interactions with the personal characteristics of individuals' are substantial determinants of human behaviour; this acknowledgement formed the foundation of modern social learning theories (Fraser, 1989, 2012a). Lewin's (1936) formula for human behaviour, as shown in Equation 2.1, emphasises the need for research in which behaviour is recognised as a function of both the person and the environment (Fraser, 1989).

Equation 2.1

$$\mathbf{B} = \mathbf{f}(\mathbf{P}, \mathbf{E})$$

Where:

B = human behaviour

P = person

E = environment

f = function (of)

Expanding on Lewin's theory, Murray (1938) developed the needs-press model, which represents a person and their environment and depicts behaviour as an outcome of the interactions between a person's *needs* and the *press* that acts upon them. In this model, *needs* are understood as motivational personality traits that represent people's tendency to move in the direction of particular goals (Gardner, 1975); *press* refers to environmental pressures on behaviour that can either support or hinder the actualisation of an individual's needs (Murray, 1938). According to the needs-press model, for each need, there is an associated press (Gardner, 1975).

Murray (1938) also distinguished between two kinds of press: *alpha press* (the environment as assessed by a detached observer) and *beta press* (the environment as perceived by inhabitants of the milieu). Murray's work was expanded upon by Stern, Stein, and Bloom (1956), who described the personal view that an individual has of their environment as *private beta press* and the shared view that all group members have of their environment as *consensual beta press*. The work previously described of Lewin (1936) and Murray (1938), contributed to the foundation for later work in the field of learning environment research.

The field of learning environment research was pioneered by the work of both Moos (1973, 1974, 1979) and Walberg (1979), who began "seminal independent programmes of research" (Fraser, 2012b, p. 1192). Moos focused on the psychosocial aspects of a variety of environments including prisons, psychiatric hospitals, and

classrooms (Moos, 1973, 1974). Moos' (1974, 1979) conceptual framework for these human environments was crucial to his theory related specifically to the classroom environment. Moos (1979) extended Lewin's theory of environmental influence on individuals by developing a human environments framework which included the psychosocial aspects of the learning environment. Moos' work within classrooms led to his development of the Classroom Environment Scale (CES; Moos & Trickett, 1974). The CES conceptualises the psychosocial classroom environment as a dynamic social system that includes the interactions between teachers and students as well as those between students and their peers. Together, these important contributions made Moos one of the founders of learning environments research.

Whereas Moos' work focused on psychosocial aspects of a variety of human environments, Walberg's pioneering research in the field of learning environments was triggered by the evaluation of the Harvard Project Physics (Anderson & Walberg, 1968), a project that developed physics curriculum materials designed to promote the teaching of science in secondary classrooms. In the context of evaluating this project, Walberg became one of the first scholars to suggest that the evaluation of curriculum innovations should involve more than simply achievement data and that psychosocial aspects of the learning environment were important. As such, to assess the impact of the curriculum resources created for the Harvard Project Physics, Walberg developed the well-known Learning Environment Inventory (LEI; Walberg & Anderson, 1968). Fraser (2012b, 2012c) observed that the development of numerous other learning environment surveys built upon the work of Moos and Walberg.

Influenced by Lewin's (1936) and Murray's (1938) earlier work, Moos and Trickett (1974), developed a conceptual framework depicting the interrelationships between the classroom social climate and other characteristics of the classroom environment (Moos, 1980). The model suggests that the school and classroom climates can be influenced directly or indirectly by school and classroom context (such as location), organisational factors, physical and architectural features, and student and teacher characteristics.

Based on the work of Lewin (1936) and Murray (1938), Moos (1974) also identified three dimensions that characterise any social-environmental setting. The first

dimension, relationships, describes the extent to which individuals are supportive of each other in a particular environment. The second dimension, personal development, describes the degree of opportunities for personal growth and enhancement in the environment. The third dimension, system maintenance and change, assesses the “extent to which the environment is orderly and clear in its expectations, maintains control and responds to change” (Moos, 1979, p. 16). According to Moos (1974), these dimensions exist side-by-side in all human environments; this set of three dimensions has been widely utilised by subsequent researchers in the development of classroom learning environment instruments (Fraser, 2007).

This section (Section 2.2.1) has elucidated the origins of learning environments research. The following section (Section 2.2.2) outlines key findings from subsequent learning environment research that has built on the pioneering work outlined above. Together, the research reviewed in these two sections informed the study reported in this thesis.

2.2.2 Past Learning Environment Research

Historically, learning environment surveys have been the predominant source of data collection about the learning environment and extensive research has been undertaken in this field using a variety of instruments (some of which were outlined in Section 2.2.3). Twelve major lines of past research in the field of learning environments were identified by Fraser (1998a), these being:

1. Research examining the associations between the learning environment and student outcomes;
2. Research investigating educational innovations;
3. Research examining the differences between students’ and teachers’ perceptions of the learning environment;
4. Research investigating whether students achieve better academic results when a high correlation exists between the actual learning environment and that preferred by students;
5. Research reporting teachers’ efforts to improve their classroom climates;
6. Research combining quantitative and qualitative methods;

7. Research on the psychosocial learning environment to enhance the work of school psychologists;
8. Research investigating the links between two or more educational environments;
9. Research involving cross-national studies;
10. Research investigating the transition from primary to secondary education;
11. Research related to teacher education; and
12. Research related to teacher assessment.

Of relevance to the present study were the research lines related to the associations between student outcomes and learning environments and whether students achieve better academic results when a high correlation exists between the actual classroom environment and that preferred by students. The following sub-sections (Section 2.2.2.1 and Section 2.2.2.2) review literature related to each of these lines of research.

2.2.2.1 Associations between Learning Environments and Student Outcomes

Modern learning environment research has most commonly investigated connections between students' perceptions of the psychosocial characteristics of the classroom environment and their cognitive and affective outcomes (Dorman, 2002; Fraser, 1998a, 2012c; Fraser & Fisher, 1982; Haertel, Walberg, & Haertel, 1981). Numerous studies have suggested that the quality of the classroom environment significantly impacts student learning (Bell & Aldridge, 2014; Dorman, 2002; Dorman & Fraser, 2009; Fraser, 1994, 1998a, 2012c; Fraser & Fisher, 1982; McDonald, 2013). That is, students tend to learn better when they perceive their learning environment to be more favourable. Specifically, strong positive associations have been found to exist between students' perceptions of the classroom environment and specific student outcomes such as academic achievement (Chionh & Fraser, 2009; Cohn & Fraser, 2016; Fraser, Treagust, & Dennis, 1986; Goh, Young, & Fraser, 1995; Teh & Fraser, 1995; Wolf & Fraser, 2008); self-regulation (Velayutham & Aldridge, 2013); efficacy (Al Zubaidi et al., 2016; Bell & Aldridge, 2014; Chionh & Fraser, 2009; Dorman, 2001; Dorman & Fraser, 2009; Velayutham & Aldridge, 2013); satisfaction of learning (Fisher, Henderson, & Fraser, 1995); enjoyment of subject (Bell & Aldridge, 2014; Ogbuehi

& Fraser, 2007; Telli, den Brok, & Cakiroglu, 2010); enjoyment of learning (Walker & Fraser, 2005); attitude towards subject (Dorman & Fraser, 2009; Martin-Dunlop & Fraser, 2008; Teh & Fraser, 1995; Telli et al., 2010); and attitude towards class (Cohn & Fraser, 2016).

Strong associations between favourable student perceptions of their classroom environment and enhanced student outcomes have been confirmed around the world in countries such as the United States of America (USA; Martin-Dunlop & Fraser, 2008; Pickett & Fraser, 2009); the United Arab Emirates (UAE; Aldridge, Afari, et al., 2012; MacLeod & Fraser, 2010); Indonesia (Fraser, Aldridge, & Adolphe, 2010; Wahyudi & Treagust, 2004); Taiwan (Aldridge & Fraser, 2000; Aldridge, Fraser, & Huang, 1999); South Africa (Aldridge et al., 2009); Korea (Kim, Fisher, & Fraser, 2000); India (Koul & Fisher, 2005); Papua New Guinea (Waldrup & Wong, 1996); Brunei Darussalam (Majeed, Fraser, & Aldridge, 2002; Scott & Fisher, 2004); and Jordan (Al Zubaidi et al., 2016). As such, educators should not underestimate the influence of the classroom environment on student learning.

Whereas much of the research referred to above was conducted in secondary or tertiary education settings, few studies have examined associations between student perceptions of the learning environment and related student outcomes in primary school settings. The few past studies that have assessed the primary school learning environment are described below.

Goh and Fraser (1998) established associations between the learning environment and student attitudes and achievement in mathematics through using the QTI and a modified version of the My Class Inventory (MCI) with a sample of 1,512 Singaporean primary school students. Scott and Fisher (2004) translated a primary school version of the QTI into Malay and used the resulting instrument in Brunei Darussalam to assess students' enjoyment of science lessons. Research by Scott and Fisher (2004) indicated that there were positive correlations between teachers' helping/friendly behaviours and primary school students' enjoyment of science and academic achievement. The results also suggested that there was a negative relationship between student achievement and teachers' feelings of uncertainty in relation to managing student behaviour. In Texas, Scott Houston, Fraser, and

Ledbetter (2008) used the MCI to compare primary school students' perceptions of their classroom environments when utilising science textbooks and teacher-generated materials. The results of this study suggested that students experienced greater satisfaction in learning environments that involved lower levels of friction amongst students and greater levels of cohesiveness. Although each of these past studies has shown associations between student perceptions and outcomes at the primary school level, these studies have all investigated student perceptions in relation to a specific subject rather than the primary classroom environment as a whole. Therefore, the study reported in this thesis extends the field of learning environment research by examining the relationships between the broader classroom learning environment at the primary school level and student outcomes.

2.2.2.2 Students' Academic Achievement when the Actual and Preferred Environments are Highly Correlated

Many learning environment surveys allow the assessment of students' perceptions of their learning environment, thus evaluating the classroom setting "through the eyes of the participants themselves" (Fraser, 2012c, p. 1192). The use of perceptual measures to assess students' actual and preferred environments, allows the exploration of whether student achievement is greater when students' perceptions of the actual environment and their preferred environment are highly correlated. As the learning environment surveys utilised in the present study drew on actual and preferred student perceptual data³, past studies using this approach are of particular relevance. As such, this section reviews previous studies which have utilised actual and preferred student perceptual measures.

Numerous studies have examined the differences between students' actual and preferred perceptions of their learning environments in secondary (Aldridge, Fraser, et al., 2012; Aldridge et al., 2004; Dorman, 2008b; Koh & Fraser, 2014; Lai et al., 2015; Rekha et al, 2011; Rita & Martin-Dunlop, 2011) and tertiary (MacLeod & Fraser, 2010) education settings. Fewer studies have investigated the actual and preferred learning environment perceptions of primary school students, but the limited

³ Further information about the surveys used in the present study can be found in Sections 4.2, 4.3, and 4.4 of Chapter 4.

number of studies conducted at the primary school level have all concluded that primary school-aged students were able to provide valuable feedback to teachers about their perceptions of their learning environment. These studies are outlined below.

Sinclair and Fraser (2002) compared the actual and preferred learning environment perceptions of upper primary and middle school students and teachers in Texas using the Inventory of Classroom Environments (ICE), which was based on the What is Happening in this Class? (WIHIC) survey (Fraser, McRobbie, & Fisher, 1996). The results of that study suggested, first, that teachers perceived the learning environment more positively than their students and, second, that both teachers and students preferred a more favourable learning environment than was perceived to be present. Although the ICE examined students' actual and preferred perceptions of their primary school learning environment, this survey included only four scales (Cooperation, Teacher Empathy, Involvement, and Task Orientation), which provided a limited view of the classroom environment. In addition, the factor and item validity in Sinclair and Fraser's (2002) study were not strong given that 10 of the original items were omitted during validation and two of the original five scales (Teacher Support and Equity) were combined to form the Teacher Empathy scale.

Aldridge et al. (2009) investigated the actual and preferred perceptions of primary school students involved in distance education in South Africa using a primary school version of the WIHIC. However, the scope of this study (only one class of distance education students) meant that the generalisability of the findings was limited. In another study at the primary school level, Magen-Nagar and Steinberger (2017) used the Technology Rich Outcomes Focused Learning Environment Instrument (TROFLEI; Aldridge, Dorman & Fraser, 2004), which was initially developed for use with secondary students, to assess Israeli primary and middle school students' actual and preferred differences of a technology-rich classroom environment.

Previous learning environment research, including studies at the primary school level, suggests that students generally prefer a more positive learning environment than that which is actually experienced (Aldridge et al., 2009; Aldridge, Fraser, et al., 2012; Aldridge, Dorman, & Fraser, 2004; Dorman, 2008a, 2008b; Fraser & Fisher, 1983b; Henderson et al., 2000; Koh & Fraser, 2014; Koul et al., 2011; Lai et al., 2015; Magen-

Nagar & Steinberger, 2017; Rekha et al.; 2011; Rita & Martin-Dunlop, 2011; Wong et al., 2006). Research conducted by Fraser and Fisher (1983a) into the match between students' actual and preferred classroom environments suggested that the correlation between students' actual and preferred learning environments was as important in determining student outcomes as the learning environment itself. The implications of this study suggested that attempting to change the actual learning environment to more closely match the preferred environment of the class could lead to enhanced student achievement (Fraser, 2012c). This conclusion is consistent with a range of international research that suggests that students achieve better academic outcomes in their preferred environments (Chionh & Fraser, 2009; Cohn & Fraser, 2016; Goh et al., 1995; Fraser et al., 1986; Teh & Fraser, 1995; Wolf & Fraser, 2008).

This section (Section 2.2.2) has summarised the two major lines of past learning environment research (drawn from the twelve lines of research elucidated by Fraser, 1998a): first, the associations between learning environments and student outcomes (Section 2.2.2.1) and, second, whether students achieve better academic results when a high correlation exists between the actual and preferred environment (Section 2.2.2.2). In doing so, this section has highlighted the fact that many of the instruments used in these two past lines of research were designed for use in secondary or tertiary educational settings, whereas relatively few learning environment surveys exist for use at the primary school level. The following section (Section 2.2.3) discusses the need for a new learning environment instrument for use with primary school-aged students.

2.2.3 The Need for a New Learning Environment Instrument

Following the work of Moos and Walberg in the USA (outlined in Section 2.2.1), numerous learning environment instruments have been developed around the world for a variety of purposes. Although extensive research has been conducted in the area of learning environments using a range of surveys, the majority of this work has related to secondary and tertiary education contexts. For example, the Classroom Environment Scale (CES; Moos, 1974); Individualised Classroom Environment Questionnaire (ICEQ; Rentoul & Fraser, 1979); QTI (Wubbels & Levy, 1991); WIHIC (Fraser et al., 1996); TROFLEI (Aldridge, Dorman & Fraser, 2004); and

Constructivist-Oriented Learning Environment Survey (COLES; Aldridge, Fraser, et al., 2012) were all developed to assess students' perceptions of secondary school classrooms. The Science Laboratory Environment Inventory (SLEI; Fraser, Giddings, & McRobbie, 1995) was developed for use in both secondary and tertiary educational settings.

Although some past studies have investigated students' perceptions of the learning environment at the primary school level, a number of these studies have investigated either aspects or outcomes of the learning environment that are not pertinent to the present study. For example, Martin-Dunlop and Fraser (2008) examined the perceptions of prospective elementary school teachers (rather than students). In another study, Ferguson and Fraser (1999) focused on students' transitions between primary and secondary school settings.

Other learning environment research conducted at a primary school level has utilised instruments that were not suitable for use in the present study. In one such study, Goh and Fraser (1998) implemented the QTI in Australian primary school settings; however, the factor structure of the QTI in this study was not reported, and the QTI focused on relationships rather than the broader learning environment. In other studies, researchers have implemented modified versions of the WIHIC (Aldridge et al., 2009) and MCI (Majeed, Fraser, & Aldridge, 2002; Mariani, Villares, Christopher, Colvin, & Summer, 2015; Scott Houston et al., 2008; Sink & Spencer, 2005) in primary school classrooms. However, neither of these versions, which were limited in scales, provide a broad view of the learning environment (Aldridge & Galos, 2017).

Overall, the review of literature summarised above indicates that there is a dearth of valid and reliable surveys available to assess students' perceptions of the learning environment at the primary school level. As such, it was considered necessary for the researcher to develop new surveys for use in the present study. The following sections review six learning environment instruments (summarised in Table 2.1) that informed the development of the new surveys used in the present study. First, the LEI (Walberg & Anderson, 1968; see Section 2.2.3.1) and the CES (Moos, 1974; see Section 2.2.3.2) are reviewed as instruments that, although not suitable for use with primary school students, are of historical importance to the study. Next, the MCI (Fisher & Fraser,

1981; see Section 2.2.3.3); the WIHIC (Fraser et al., 1996; see Section 2.2.3.4); and the QTI (Wubbels & Levy, 1991; see Section 2.2.3.5) are examined since these surveys have previously been used in primary classroom settings. Finally, the COLES (Aldridge, Fraser, et al., 2012; see Section 2.2.3.6) is examined as a more contemporary survey. Section 2.2.3.7 summarises the review of the instruments that informed the present study.

Table 2.1. Overview of six classroom environment instruments

| Instrument | Level | Items per scale | Scales classified according to Moos's (1974) scheme | | | References |
|--|-----------------------|-----------------|---|--|--|--|
| | | | Relationship dimensions | Personal development dimensions | System maintenance and change dimensions | |
| Learning Environment Inventory (LEI) | Secondary | 7 | <ul style="list-style-type: none"> • Cohesiveness • Friction • Favouritism • Cliqueness • Satisfaction • Apathy | <ul style="list-style-type: none"> • Speed • Difficulty • Competitiveness | <ul style="list-style-type: none"> • Diversity • Formality • Material Environment • Goal Direction • Disorganisation • Democracy | <ul style="list-style-type: none"> • Fraser, Anderson, and Walberg (1982) • Walberg and Anderson (1968) |
| Classroom Environment Scale (CES) | Secondary | 10 | <ul style="list-style-type: none"> • Involvement • Affiliation • Teacher Support | <ul style="list-style-type: none"> • Task Orientation • Competition | <ul style="list-style-type: none"> • Order and Organisation • Rule clarity • Teacher Control • Innovation | <ul style="list-style-type: none"> • Moos (1974) • Moos and Trickett (1987) |
| My Class Inventory (MCI) | Upper primary | 6 to 9 | <ul style="list-style-type: none"> • Cohesiveness • Friction • Satisfaction | <ul style="list-style-type: none"> • Difficulty • Competitiveness | | <ul style="list-style-type: none"> • Fisher and Fraser (1981) • Fraser, Anderson, and Walberg (1982) • Fraser and O'Brien (1985) |
| Questionnaire on Teacher Interaction (QTI) | Primary and secondary | 8 to 10 | <ul style="list-style-type: none"> • Helpful / Friendly • Understanding • Dissatisfied • Admonishing | | <ul style="list-style-type: none"> • Leadership • Student Responsibility and Freedom • Uncertain • Strict | <ul style="list-style-type: none"> • Créton, Hermans, and Wubbels (1990) • Wubbels, Brekelmans, and Hooymayers (1991) • Wubbels and Levy (1993) |

| Instrument | Level | Items per scale | Scales classified according to Moos's (1974) scheme | | | References |
|---|-----------|-----------------|---|---|---|---|
| | | | Relationship dimensions | Personal development dimensions | System maintenance and change dimensions | |
| What is Happening in this Class? (WIHIC) | Secondary | 8 | <ul style="list-style-type: none"> • Student Cohesiveness • Teacher Support | <ul style="list-style-type: none"> • Investigation • Task Orientation • Collaboration | <ul style="list-style-type: none"> • Equity | <ul style="list-style-type: none"> • Fraser, McRobbie, and Fisher (1996) • Aldridge, Fraser, and Huang (1999) |
| Constructivist-Orientated Learning Environment Survey (COLES) | Secondary | 7 to 8 | <ul style="list-style-type: none"> • Equity • Teacher Support • Student Cohesiveness • Young Adult Ethos • Personal Relevance • Involvement | <ul style="list-style-type: none"> • Formative Assessment • Clarity of Assessment Criteria • Task Orientation • Collaboration | <ul style="list-style-type: none"> • Differentiation | <ul style="list-style-type: none"> • Aldridge, Fraser, Bell, and Dorman (2012) |

Adapted from Fraser (1998a) and Bell and Aldridge (2014). Used with permission⁴.

⁴ Permissions can be found in Appendix 1.

2.2.3.1 *Learning Environment Inventory (LEI)*

The LEI (Walberg & Anderson, 1968) is a historically significant instrument given that it was the first contemporary learning environment survey to be developed. The development and validation of the LEI were conducted by Walberg and Anderson (1968) in the United States in conjunction with research related to the Harvard Project Physics (Fraser, 1998a). The LEI was intended to assess the perceptions of each individual student and to aggregate this data to obtain perceptions about the learning environment from the class as a whole (Fraser, Anderson, & Walberg, 1982). The LEI contains 15 scales with seven statements per scale and is designed for secondary school students. The response format includes four alternatives: *strongly disagree*, *disagree*, *agree*, and *strongly agree*. The scoring direction is reversed for some items. The LEI includes both positive and negative scales (Haertel, Walberg, & Haertel, 1981). The positive scales are Cohesiveness, Satisfaction, Task Difficulty, Formality, Goal Direction, Democracy, Environment, and Competition. The negative scales are Friction, Cliqueness, Speed, Apathy, Favouritism, Disorganisation, and Diversity. A sample item from the Cohesiveness scale is *All students know each other very well*; a sample item from the Speed scale is *The pace of the class is rushed* (Fraser, 1998a). Fraser (2012b) observed that the development of numerous other learning environment surveys built upon Walberg's LEI. However, in the 50 years since the LEI was developed, the field of learning environments has undergone "remarkable growth, diversification and internationalisation" (Fraser, 1998a, p. 7), and, as such, some scales may no longer be relevant for contemporary classrooms.

2.2.3.2 *Classroom Environment Scale (CES)*

The Classroom Environment Scale (CES) is another seminal learning environment scale. It was developed by Moos (1974) for use in secondary school classrooms. The CES was developed in the context of research involving perceptual measures of a range of human milieus including psychiatric hospitals, correctional facilities, universities, and work settings (Fraser, 1998a; Fraser & Fisher, 1983a; Moos, 1974). The CES involves nine scales (each containing 10 items) and utilises an actual-preferred format. The scales are Involvement, Affiliation, Teacher Support, Task Orientation, Competition, Order and Organisation, Rule Clarity, Teacher Control, and

Innovation. The response format utilises a true–false alternative. Sample items from the CES are *The teacher takes a personal interest in the students* from the Teacher Support scale and *There is a clear set of rules for students to follow* from the Rule Clarity scale (Fraser, 1998a). The CES has been utilised for a variety of research purposes, and studies of relationships between student learning environment perceptions and student outcomes using the CES have been conducted by a number of researchers (Fraser & Fisher, 1983a; Moos & Moos, 1978; Moos & Trickett, 1974). Fraser (2012b) observed that the development of numerous other learning environment surveys built upon the work of Moos’ CES. However, some scales, such as Teacher Control, were developed for teacher-centred classrooms, making this instrument no longer suitable for contemporary student-centred learning environments, such as the classrooms in the present study.

2.2.3.3 *My Class Inventory (MCI)*

The MCI was simplified from Walberg and Anderson’s (1968) LEI for use among 8 to 12-year-old Australian children (Fisher & Fraser, 1981; Fraser et al., 1982). Although designed for use with primary school students, the MCI was also found to be useful with middle school students, especially those who struggled with the literacy demands of the LEI (Fraser, 1998a; Fraser et al., 1982). The wording of items within the MCI was simplified to accommodate the younger age of the intended respondents. Only five of the LEI scales were retained in an attempt to minimise fatigue among respondents. The scales of the MCI are Cohesiveness, Friction, Difficulty, Satisfaction, and Competitiveness. The MCI has a simplified yes–no response format and students respond on the questionnaire itself rather than on a separate page to avoid errors in transferring responses from one sheet to another (Fraser, 1998a).

The original version of the MCI contained nine items in each of the five scales; however, several researchers made adjustments to further simplify the instrument. Fraser et al. (1982) reduced the number of items from 45 to 38; Fisher and Fraser (1981) developed a shorter 25-item version; and Goh et al. (1995) altered the yes–no response format to a three-point response format of *seldom*, *sometimes*, and *most of the time*. Typical items found within the MCI (using the version by Goh et al., 1995)

include *Many pupils in our class like to fight* (from the Friction scale) and *All the pupils in my class like one another* (from the Cohesion scale).

The MCI was not considered to be suitable for use in the present study due to two key limitations. First, there are concerns related to the reliability and validity of the instrument. The alpha reliability coefficients for the original version of the MCI revealed that some scales had low internal consistency (Fraser et al., 1982). The factorial validity of some scales was not established in the earlier studies and, hence, several scales and items were omitted. Some later studies utilising Fisher and Fraser's (1981) version of the MCI did report factor analyses. For example, Majeed et al. (2002) adapted Fisher and Fraser's (1981) version of the MCI for use in Brunei Darussalam, reporting exploratory factor analysis with data from a sample of 1,565 lower secondary school mathematics students. In the primary school setting, Scott Houston et al. (2008) used the MCI with a sample of 588 students in three Texan schools. This study reported on the factorial validity of the MCI, indicating that one scale (Difficulty) and one item (from the Friction scale) should be rejected. Similarly, the MCI was used by Sink and Spencer (2005) in 20 schools in the USA. Using data from a sample of 2,835 grade 4 to 6 students, a five-scale 25-item survey was administered; however, after exploratory and confirmatory factor analyses, the Difficulty scale and two items from the Friction scale were omitted, reducing the modified survey to four scales (Cohesion, Competitiveness, Friction, and Satisfaction) comprising of 18 items. Using confirmatory factor analysis, Mariani et al. (2015) utilised the Sink and Spencer's (2005) version of the MCI in Florida with a sample of 893 students. However, with only four remaining scales this version of the MCI assessed a limited number of classroom environment factors.

The second limitation of the MCI is that student satisfaction was included as a scale. Conceptually, it could be argued that this construct is more of an *outcome* than a *dimension* of the learning environment (Aldridge & Galos, 2017). As a result of these two limitations, the MCI was not considered to be a viable option for use in the present study.

2.2.3.4 *What is Happening in this Class? (WIHIC)*

The WIHIC survey was initially developed for the secondary school setting by Fraser et al. (1996) and was later modified for use at the primary school level by Aldridge et al. (2009). According to Fraser (2012c), the WIHIC has been used extensively around the world. According to Fraser (2012c), the WIHIC combines modified versions of the most salient scales from a range of existing surveys with additional scales being incorporated to measure contemporary educational developments and issues such as student understanding and equity (Fraser et al., 1996). Two versions of the WIHIC exist: a personal and a class form. Based on the assumption that individuals construct their own understanding of their environment, the personal form assesses student perceptions of their own role in the classroom whereas the class version assesses student perceptions of the class as a whole.

After analysis of data gathered from 355 secondary school science students, the WIHIC was reduced from the original 90-item nine-scale version to a 54-item seven-scale survey (Fraser et al., 1996). This modified version was then expanded upon by Aldridge et al. (1999) to create a version comprising of 80 items within eight scales. The 80-item version was field tested in Australia, Taiwan, and China, and the final version that resulted from that testing (containing 56 items within seven scales) was successfully validated in Singapore (Fraser et al., 1996). The seven scales are Student Cohesiveness, Teacher Support, Involvement, Investigation, Task Orientation, Collaboration, and Equity, with each scale containing eight items. The final version of the WIHIC has subsequently been validated in several countries including the USA (Allen & Fraser, 2007; Martin-Dunlop & Fraser, 2008); Canada (Zandvliet & Fraser, 2005); Singapore (Khoo & Fraser, 2008); New Zealand (Saunders & Fisher, 2006); and Australia (Aldridge & Fraser, 2000; Dorman, 2008a). The WIHIC has also shown satisfactory reliability when used across several subject areas including mathematics, English, science, and ICT. Hence, the WIHIC has been established internationally as a valid and reliable measure of classroom learning environments (Dorman, 2003).

A modified version of the WIHIC for use at the primary school level was developed by Aldridge et al. (2009) and tested in South Africa (namely the WIHIC-Primary). In this modified version, the number of items was reduced to 36 across six scales (Student

Cohesiveness, Teacher Support, Involvement, Task Orientation, Collaboration, and Equity) to suit the concentration span of primary-aged students. The response scale was also modified to a three-point frequency scale of *almost never*, *sometimes*, and *almost always*. Due to poor factor analysis results, two scales and an additional five items outside of these two scales were omitted. The remaining four scales and 19 items of the WIHIC-Primary displayed satisfactory factorial validity and had good internal consistency reliability; however, the four scales provide a limited view of the learning environment (Aldridge & Galos, 2017). Therefore, the WIHIC-Primary was not considered to be suitable for use in the present study.

2.2.3.5 Questionnaire on Teacher Interaction (QTI)

The QTI was developed in the Netherlands by Wubbels, Creton, and Hooymaners, (1985) and was based on research related to the nature and quality of interpersonal relationships between teachers and students. According to Fisher, Fraser, and Cresswell (1995) and Goh and Fraser (1998), that research assumed that the behaviours of teachers and students are mutually influential and, as such, that interactions between students and teachers in the classroom environment are important. Wubbels and Levy (1993) later developed an English version of the QTI. The QTI examines eight aspects of interpersonal behaviour between teachers and students, namely, Leadership, Helpful/Friendly, Understanding, Student Responsibility and Freedom, Uncertain, Dissatisfied, Admonishing, and Strict Behaviour. The QTI originally contained 77 items and was validated in the Netherlands (Wubbels, Brekelmans, & Hooymaners, 1991) and the USA (Wubbels & Levy, 1993). However, the QTI was then adapted for use in Australia (Fisher, Henderson, et al., 1995; Goh & Fraser, 1996), with the Australian version being shorter (48 items) and using a five-point response scale ranging from *never* to *always*. Typical items include *This teacher gives us a lot of free time in class* (from the Student Responsibility and Freedom scale) and *This teacher is sarcastic* (from the Admonishing Behaviour scale).

The QTI is administered to both teachers and their students, providing data about each groups' perceptions of the interpersonal behaviours shown by the teacher. Students can be asked to respond based on their perceptions of either their actual teacher or the

teacher considered to be their “best” teacher. Similarly, teachers can be asked to respond based on their perceptions of either their own behaviour or their ideal behaviour, allowing a minimum of four sets of perception data to be gathered (Fisher, Fraser, et al., 1995).

The QTI was developed primarily for use in secondary schools, but it has also been modified for use in primary school settings (Goh & Fraser, 1996, 1998). Goh and Fraser (1998) validated their primary version of the QTI in Singapore with a sample of 1,512 10- and 11-year-old students from 13 primary schools. The original five-point response scale of the QTI was modified to a three-point scale consisting of *seldom*, *sometimes*, and *most of the time* to make the response format more suitable for primary students. The primary version was reduced to 48 items, and the wording of items was simplified to improve readability for younger students. For example, the item *The teacher takes a personal interest in us* was adapted to *The teacher cares about us*. The QTI (Primary) scales measure the same eight dimensions of teacher behaviour as the secondary school version.

Despite its use in the primary setting, the QTI was not a viable option for use in the present study for two reasons. First, the factor structure of the QTI was not reported in previous studies; second, the focus of the QTI was primarily on the student–teacher relationship rather than the broader learning environment as a whole (Aldridge & Galos, 2017).

2.2.3.6 *Constructivist-Oriented Learning Environment Survey (COLES)*

The COLES was designed by Aldridge, Fraser, et al. (2012) to gather information about secondary school students’ perceptions of their learning environments. The COLES was validated by Aldridge, Fraser, et al. (2012) as a reliable instrument using Trochim and Donnelly’s (2008) construct validity framework and a sample of 2,043 year 11 and 12 students from 147 classes in 9 Western Australian schools. Based on constructivist pedagogy, the development of the COLES focused on the inclusion of scales linked to student-centred principles of learning. Whereas some existing learning environment surveys (such as the MCI and QTI; see Sections 2.2.3.3 and 2.2.3.5) focused on relationships and instruction, the COLES also included scales related to

student assessment. The COLES was developed based on the WIHIC; the original version of the COLES included 11 scales with 88 items. However, adaptations were made (primarily to reduce student fatigue) resulting in a refined version with 11 scales and 67 items (Bell, 2013). The COLES incorporates 11 dimensions which can be grouped into three categories: Relationships (Equity, Teacher Support, Student Cohesiveness, and Young Adult Ethos); Assessment (Formative Assessment and Clarity of Assessment Criteria); and Delivery (Task Orientation, Personal Relevance, Involvement, Differentiation, and Collaboration). The response format utilises a five-point frequency scale consisting of *almost never*, *seldom*, *sometimes*, *often* and *almost always*. Using a side-by-side actual–preferred response format, the COLES collects data about how students perceive both the current classroom environment (actual environment) and their ideal (preferred) classroom environment (Aldridge, Fraser, et al., 2012; Bell & Aldridge, 2014). Given that no suitable instrument existed for use in the present study at the primary school level, the COLES was selected as a valid and reliable instrument suitable for adaption for use in the present study. A further rationale for selection of the COLES for this purpose is provided in the following section (Section 2.2.3.7)

2.2.3.7 Selection of Instruments to Inform the Present Study

When evaluating the suitability of the existing instruments (summarised in Sections 2.2.3.1 to 2.2.3.6) for the present study, it was evident that most of the available instruments (specifically, the LEI, the CES, and the QTI) were developed for use with secondary school students. The limitations of the instruments adapted for the primary school setting, (the MCI and WIHIC-Primary) described in Sections 2.2.3.3 and 2.2.3.4 rendered them unsuitable for the present study.

Given that no existing questionnaires for the primary classroom were deemed as suitable for the purposes of this research, the COLES was selected as the basis for the development of a new primary learning environment survey. There were four reasons for this decision. First, the COLES had previously been validated and found to be a reliable tool for use in Australian secondary school classrooms (Aldridge, Fraser, et al., 2012; Bell & Aldridge, 2014). Second, the development of the COLES in Western Australia ensured its applicability for the location of the present study. Third, the

COLES was used because it is based on constructivist pedagogical principles (Aldridge, Fraser, et al., 2012). Fourth, the COLES examines the classroom environment as a whole, including a focus on relationships (both teacher–student and student–student). Finally, the actual and preferred response format of the COLES allows important data to be gathered about the differences between students’ perceptions of the current classroom environment and their preferred environment.

Given the strong reliability of the COLES and the applicability of a number of its scales to the research reported in this thesis, nine scales were drawn from the COLES to inform the development of the new instrument: Student Cohesiveness, Teacher Support, Equity, Task Clarity, Responsibility for Learning, Involvement, Task Orientation, Personal Relevance, and Collaboration. The way in which the COLES was used to develop the new survey instrument is described further in Section 3.5.1 in Chapter 3 and Section 4.2 of Chapter 4.

This section (Section 2.2.3) has outlined numerous surveys that have previously been developed to assess student perceptions of the learning environment. This review of past learning environment instruments has revealed a lack of valid surveys suitable for assessing students’ perceptions of their learning environments in the primary school setting. Consequently, the research reported in this thesis fills a research gap through the development of a new survey for use in the primary school classroom to assess students’ perceptions of the primary school learning environment. The next section (Section 2.3) relates to the investigation of ICT use in the classroom within the present study.

2.3 Using ICT to Enhance Learning

For the purposes of this study, the terms digital technology and ICT are used interchangeably to refer to both hardware and software that may be used in the classroom environment. Hardware may include devices such as desktop computers, laptops, Chromebooks, iPads, and interactive whiteboards. Software may include the internet, web-based programs, computer programs (such as Microsoft Word or PowerPoint), and applications such as Keynote or iMovie. Digital tools, both hardware and software, can be used to create, adapt and share information.

The next section (Section 2.3.1) reviews literature related to the importance of ICT use in learning environments. Section 2.3.2 then reviews past research linking learning environments research with the use of ICT to enhance student learning (research objectives 2 to 4). Finally, Section 2.3.3 investigates existing instruments used to examine ICT use within the classroom.

2.3.1 The Importance of ICT Use in the Learning Environment

Rapidly advancing technology and the ubiquitous nature of technological devices are changing our social and cultural environments—including educational environments (Fullan, 2012). ICT is now integral to creating and sharing information and knowledge around the world, and ICT affects our lives within our schools, our workplaces, our communities, and our homes (Fraillon et al., 2014). As a result, knowledge about, access to, and the ability to use ICT are essential in order for people to actively and effectively participate in modern society (Aesaert et al., 2015; Ahuja, 2016; Fraillon et al., 2014; Valtonen et al., 2015). Increasingly, digital devices are becoming more portable and, hence, a part of our daily lives—with classroom environments being no exception to this trend (Collins & Halverston, 2009; Duignan, 2012). As Hubber and Loong (2013, p. 84) stated, “ICT as a learning technology, facilitating mobility and connectivity, has now moved out of the computer room into the everyday practice of teaching and learning.”

Technology has become so omnipresent that digital literacy is now a basic life skill, and digital competencies open possibilities that can improve people’s quality of life (Ates, 2013; Lee, Lee, & Hwang, 2015). As such, it is becoming increasingly difficult to separate the notion of the learning environment from technology, and to do so would be disadvantageous for students who are twenty-first century learners (Fullan, 2012; Jukes, McCain, & Crockett, 2010, 2011; Siddiq et al., 2016; Valtonen et al., 2015). Bernard (2012, p. 9) argued that today’s education systems must evolve in order to effectively respond to the rapidly changing demands of society, saying that “innovations in curricula, methodologies, materials and technologies may require major changes in the design and organisation of the environments in which they are housed.” Given this emergence of technology within society, the use of ICT has become a fundamental learning tool (Kim, Kil, & Shin, 2014). Internationally, the

integration of ICT into schools has been seen as sufficiently important for improving teaching and learning that many governments have invested heavily in placing digital technologies in schools (Fullan & Donnelly, 2013; Maharaj-Sharma, Sharma, & Sharma, 2017; Pelgrum, 2001).

The stance taken in the present study was that, when considering classroom environments and their impact on learners, it is necessary to conceptualise technology as an element within the modern classroom environment and, consequently, to consider how technology can be used to enhance learning. Some of the benefits of computer-supported education include enhancing the quality of teaching, overcoming issues of time, allowing for the presentation of content in different formats, supporting the creation of flexible learning environments, and improving the academic achievement of students (Alessi & Trollip, 2001). Dumont and Istance (2010, p. 25) stated that not only do digital media have the potential to transform learning environments but, in fact, “technology can help empower learners to become active in shaping their own learning environments.” Although the integration of technology can transform teaching (Wilkin, Rubino, Zell, & Shelton, 2013) and create learning environments that are interactive, easily-accessible, flexible, meaningful, collaborative, and engaging (Demir & Basol, 2014; Mentor, 2015), to have the greatest impact on learning ICT must be used in ways that are meaningful to educational practice (Song, Kidd, & Owens, 2011). That is, technology used for its own sake is unlikely to impact on student outcomes; instead, ICT must be used in ways that are meaningfully and purposefully related to learning activities.

Past research has provided inconsistent indications as to the relationships between ICT in classrooms and various student outcomes. Some past studies have indicated that the use of technology in the classroom has a positive impact on student achievement (Ahuja, 2016; An, Alon, & Fuentes, 2015; Cheung & Slavin, 2013; Comi, Argentin, Gui, Origo, & Pagani, 2017; Demir & Basol, 2014; Kidd & Keengwe, 2012; Luu & Freeman, 2011; Pili & Aksu, 2013; Tamim, Bernard, Borokhovski, Abrami, & Schmid, 2011). Further, Ahuja (2016) and Ozdemir (2015) found that positive relationships exist between the integration of ICT and other student outcomes, such as, interest, engagement, and active participation. On the other hand, Scherer, Rohatgi, and Hatlevik (2017) and Teo (2012) indicated that students’ level of interest in and

enjoyment of ICT can influence students' level of use of ICT. A third group of studies has suggested that no significant relationship exists between computer-supported instruction and student outcomes (Angrist & Lavy, 2002; Appel, 2012; Hatlevik, Ottestad, & Throndsen, 2015). Given this lack of clarity, the present study sought to further investigate the relationships between the use of ICT in the learning environment and the affective student outcomes of self-efficacy, enjoyment of class, and enjoyment of ICT.

In Australia, to assist teachers to integrate digital technologies into teaching and learning, ICT was included as one of the general capabilities within the Australian Curriculum (Australian Curriculum, Assessment and Reporting Authority [ACARA], n.d.). The Australian Curriculum includes seven general capabilities (literacy, numeracy, intercultural understanding, ethical understanding, personal and social capability, critical and creative thinking, and ICT) that are intended to be integrated through the content of each of the eight learning areas (English, mathematics, science, humanities and social sciences, the arts, technologies, health and physical education, and languages). The general capabilities encompass the knowledge, skills, behaviours, and dispositions that students require to become successful learners, confident and creative individuals, and active and informed citizens in the twenty-first century (ACARA, n.d.).

The positioning of ICT as a general capability and not as a learning area encourages teachers to weave technology use throughout all student learning. ICT is addressed independently from the technologies learning area and thus is not about students learning discrete technological skills (such as how to use digital hardware or software) but rather developing the capacity to utilise digital tools to adapt to new ways of completing tasks as technology develops and evolves. Originally, the key ideas within the ICT capability were organised into six interrelated elements: Investigating with ICT, Creating with ICT, Communicating with ICT, Applying Social and Ethical Protocols and Practices, Managing and Operating ICT Effectively, and Changing Trends. However, in more recent versions of the Australian Curriculum, the Changing Trends element has been omitted, leaving five interrelated elements (see Figure 2.1).



Figure 2.1. Organising elements of the Australian Curriculum ICT capability (ACARA, n.d.)⁵

Although the Australian Curriculum (ACARA, n.d.) encourages teachers to integrate ICT into all learning through the ICT general capability, Fullan and Donnelly (2013) believe that, generally, there is a lack of evidence demonstrating the impact of digital innovations on student learning. Fullan and Donnelly further note that some academic research (such as that by Higgins et al., as cited in Fullan & Donnelly, 2013, p. 11) shows a lack of causal links between the integration of technology and student achievement. The present study, therefore, aims to contribute to the broader examination of whether the integration of ICT (in this case, as outlined in the ICT general capability within the Australian Curriculum; ACARA, n.d.) significantly impacts on student self-efficacy and enjoyment (of class and use of ICT).

⁵ Permission to use Figure 2.1 can be found in Appendix 2.

2.3.2 Past Research Linking Learning Environments Research with the Use of ICT to Enhance Student Learning

This section outlines previous research related to the use of ICT within educational settings to enhance learning. Few studies were found to specifically utilise learning environments research in relation to the use of ICT; those studies that were located are the focus of this review.

Traditionally, much learning environments research has investigated the associations between cognitive and affective learning outcomes and student perceptions of the traditional classroom environment, however, the last two decades have seen this field expand to incorporate investigations of the impact of technology in the physical and online learning environment on student outcomes (Chipangura & Aldridge, 2017; Teh & Fraser, 1995; Wong et al., 2006). Chipangura and Aldridge (2017) used their newly developed Student Adaptive Learning Engagement in Mathematics (SALEM) questionnaire and the WIHIC survey (Fraser et al., 1996) with a sample of 365 secondary students in 16 Australian mathematics classrooms. Their study examined whether students' perceptions of their classroom environment differed when they were exposed to multimedia as part of teaching and learning and, further, the associations between learning environment perceptions and student engagement when students were exposed to multimedia. The results of simple correlation and multiple regression analyses suggested a positive relationship between multimedia use in the classroom and student engagement in mathematics.

The Online Learning Environment Survey (OLES) was developed by Trinidad, Aldridge, and Fraser (2005) to examine the association between perceptions of online learning environments and student enjoyment of e-learning. The OLES incorporated scales from the WIHIC survey (Fraser et al., 1996) the Constructivist Learning Environment Survey (CLES; Taylor, Fraser, & Fisher, 1997) and the TROFLEI (Aldridge et al., 2004). The results of a study using the OLES by Trinidad et al. (2005) with secondary and tertiary students in Hong Kong and Australia that examined actual and preferred differences suggested that students preferred more favourable online learning environments than those that were perceived to be present. Similar results were found by Koul et al. (2011) using the TROFLEI in secondary school science

classes in New Zealand. Research by Maor and Fraser (1996) using their Computer Classroom Environment Inventory (developed to assess students' perceptions of their inquiry based learning environment) found that students had positive perceptions of a technology integrated learning environment that allowed a more open-ended and investigative classroom environment. Similarly, research by Chang and Fisher (2001) using their Web-based Learning Environment Instrument revealed positive student perceptions of a web-based learning environment.

In terms of the associations between the use of ICT within the learning environment and affective student outcomes, research by Teh and Fraser (1995) in secondary school computer-assisted learning geography classrooms using their newly developed Geography Classroom Environment Inventory, revealed strong relationships between the learning environment, student achievement and attitudinal outcomes. Further, a study by Hatlevik et al. (2015) indicated that students' motivational beliefs (mastery orientation and self-efficacy) predicted the students' digital competence.

This section (Section 2.3.2) outlined previous research related to the use of ICT within the classroom to enhance student outcomes. The following section (Section 2.3.3) reviews existing instruments available to teachers to assess the use of ICT within the learning environment.

2.3.3 Existing Research in the Field of ICT Use to Enhance Learning

Few instruments exist to assess students' perceptions of their use of ICT within the traditional classroom learning environment. The following sections review three instruments that informed the development of the new survey used in the present study. The Computer and Information Literacy (CIL) test (Fraillon et al., 2014; see Section 2.3.3.1), the Technology-Rich Outcomes-Focused Learning Environment Inventory (TROFLEI) developed by Aldridge and Fraser (2008; see Section 2.3.3.2) and the Online Learning Environment Survey (OLES) developed by Trinidad et al., (2005; see Section 2.3.3.3) are reviewed.

2.3.3.1 *Computer and Information Literacy (CIL) test*

The International Computer and Information Literacy Study in 2013 was conducted by the International Association for the Evaluation of Educational Achievement using a sample of 60,000 students from 21 education systems around the globe (Fraillon et al., 2014). Participants were in their eighth year of schooling spanning over 3,300 schools.

The study was based on a two-strand construct; Collecting and managing Information and Producing and Exchanging Information (Fraillon et al., 2014). The research investigated the extent to which factors such as personal characteristics and school contexts influence differences in CIL outcomes. Students completed a computer-based CIL test of computer and information literacy consisting of questions and tasks followed by a questionnaire relating to background characteristics, experience and use of ICT to complete various educational tasks and attitudes toward the use of ICT.

Participants responded to questions such as *At school, how often do you use computers during lessons in the following subjects or subject areas?* using a five-point scale ranging from 1 (Never) to 5 (Every day). Results indicated a range of proficiency levels across countries. Multiple regression techniques showed statistically significant positive associations with CIL in most countries with the following variables; socioeconomic status, gender (females scored higher in all but two countries), level of experience with ICT usage, access to ICT and the internet in the home and student expected educational attainment. The study also examined ICT self-efficacy, interest and enjoyment. ICT self-efficacy referred to students' confidence in performing ICT related tasks and positive associations between CIL achievement and basic ICT self-efficacy were found to exist. Interest and enjoyment related to ICT were measured using seven items such as *It is more fun to do my work using a computer than without a computer*. Participants responded using a four-point agreement scale ranging from 1 (Strongly Agree) to 4 (Strongly Disagree).

Whilst the CIL test incorporated some similar ICT competencies as those found in the Australian Curriculum and student self-efficacy, it was not considered as an appropriate tool for the present study for several reasons. Firstly, the CIL test was

designed for secondary students and the student tasks were too complex for the age of the respondents in the present study. Secondly, the response scales were inconsistent, including both a four-point agreement scale and a five-point frequency scale. Together with the fact that the scoring direction is reversed between these two scales, the response format would be too confusing for primary school aged respondents. The response format also did not match the actual and preferred format utilised in previous learning environment surveys and would therefore not allow for consistency across the instruments utilised across the present study. Finally, the CIL test specifically measured ICT self-efficacy rather than the relationship between overall student self-efficacy as an outcome of the use of ICT and therefore did not match the purpose of the present study.

2.3.3.2 *Technology-Rich Outcomes-Focused Learning Environment Inventory (TROFLEI)*

The Technology-Rich Outcomes-Focused Learning Environment Inventory (TROFLEI) was developed by Aldridge and Fraser (2008) in response to outcomes-based education and measures students' perceptions of a technology-rich classroom environment. The TROFLEI has been implemented in secondary and post-secondary learning environments and incorporates each of the seven WIHIC scales (Student Cohesiveness, Teacher Support, Involvement, Investigation, Task Orientation, Collaboration and Equity). Three additional scales were incorporated into the TROFLEI, namely Differentiation, Computer-Usage and Young Adult Ethos. The TROFLEI includes eight items in each of its ten scales and incorporates a five-point frequency response scale (*almost never, seldom, sometimes, often, and almost always*). The TROFLEI pioneered the side-by-side actual and preferred response format utilised in the present study to economically gather perceptions about their actual classroom environment and how they would prefer their classroom to be. An example of an item from the Computer Usage scale is *I use the computer to take part in on-line discussions with other students*. The item *I do work that is different from other students' work* can be found in the Differentiation scale of the TROFLEI.

Validation of the TROFLEI involved a large-scale sample of 2317 senior secondary students across Western Australia and Tasmania and indicated strong factorial validity

and internal consistency reliability (Fraser, 2012c). This instrument was also utilised in a longitudinal study spanning four years with a sample of 1249 students, the results of which supported the TROFLEI's construct validity. This research monitored the success of outcomes based educational programs over time at a senior secondary level. Several of the scales incorporated in the TROFLEI are of relevance to the present study, in particular the Computer Usage scale which measures the extent to which computers are integrated as a communication tool and to access information. However, the TROFLEI was not a viable option for use in the present study because, firstly, outcomes based education is no longer in use in Western Australia and secondly, the TROFLEI was designed for a senior secondary classroom where as the present study takes place in a primary classroom setting.

2.3.3.3 *Online Learning Environment Survey (OLES)*

The Online Learning Environment Survey (OLES) was developed to examine the association between perceptions of online learning environments and student enjoyment (of e-learning) (Trinidad et al., 2005). The OLES was validated for use through online administration with 325 students, of which 194 were Hong Kong students (43 secondary and 153 tertiary students) and 131 were Australian (all secondary students). The sample consisted of 11 classes in total, five from Hong Kong and six from Australia. The OLES incorporated scales from the WIHIC (Fraser et al., 1996), the CLES (Taylor, Fraser, & Fisher, 1997) and the TROFLEI (Aldridge & Fraser, 2008). The original version of the OLES included 62 items and nine scales (Teacher Support, Student Autonomy, Equity, Authentic Learning, Student Interaction & Collaboration, Asynchronicity, Personal Relevance, Computer Usage, and Enjoyment). The Enjoyment scale was included to measure students' enjoyment of their e-learning environment. An actual and preferred response format was utilised as well as a five-point frequency scale (*almost always, often, sometimes, seldom, and almost never*).

Following principal axis factor analysis with oblique rotation, one scale (Assessability) was lost. Internal consistency reliability was calculated for both the actual and preferred versions, indicating good internal consistency. Mean correlation and analysis of variance (ANOVA) analyses supported discriminant validity. ANOVA

results used to investigate actual and preferred differences revealed that students would prefer a more favourable learning environment than the one perceived as being currently present. The final version of the OLES consist of 52 items in eight scales. However, the OLES was not an appropriate tool for use in the present study because, firstly, the scales were similar to those of the COLES and therefore focused more on the learning environment rather than ICT capabilities. Secondly, the OLES was designed for secondary and tertiary students where as the present study involves primary school students.

The research outlined in Section 2.3.2 and Section 2.3.3 illustrates that research into the impact of ICT in the primary school learning environment on student outcomes (such as self-efficacy and enjoyment) is lacking (Aesaert et al., 2015). A few studies have suggested that associations exist between the use of ICT in secondary school learning environments and positive student outcomes such as engagement (Chipangura & Aldridge, 2017; Dorman & Fraser, 2009; Owens, 2005). However, research relating to the associations between the use of ICT and student perceptions of the learning environment, as well as research that links these factors to student outcomes, is lacking (Chipangura & Aldridge, 2017), particularly at primary school level. Therefore, the research reported in this thesis contributes to the field of learning environments by developing and validating a new survey instrument for assessing primary school students' perceptions of the impact of ICT on both the learning environment and student self-efficacy and enjoyment.

More broadly, this section (Section 2.3) has examined literature related to the importance of using ICT within the learning environment as well as literature related to students' perceptions of ICT use within the learning environment. The present study investigated the associations that exist between students' perceptions of both the learning environment and use of ICT and the affective outcomes of self-efficacy and enjoyment (of class and use of ICT). To further inform the study, the following section (Section 2.4) reviews literature related to student self-efficacy and enjoyment.

2.4 Student Self-Efficacy and Enjoyment

Based on the indications of the literature reviewed in sections 2.2.2.1 and 2.3.2, a survey was developed to assess three affective student outcomes: self-efficacy, enjoyment of class, and enjoyment of using ICT (research objectives 1, 3, and 4). To inform the development of the new survey, this section reviews literature related to student self-efficacy (Section 2.4.1) and enjoyment (Section 2.4.2). Section 2.4.3 examines existing instruments related to self-efficacy and enjoyment.

2.4.1 Self-Efficacy

For the purposes of the present study, self-efficacy was understood as referring to “people’s beliefs about their capabilities to exercise control over events that affect their lives” (Bandura, 1989, p. 1175). Central to the field of self-efficacy research is Bandura’s (1977) social cognitive theory, which purports that a person’s self-efficacy about their capabilities has a potent influence on their behaviour. According to social cognitive theory, an individual’s self-efficacy or self-belief that they can achieve a certain goal can impact on their behaviour and the amount of energy that they expend on a particular task; for example, when an individual believes that they can be successful at a task, they are more likely to engage in the task (Bassi, Steca, Fave, & Caprara, 2007). Thus, an individual’s self-efficacy or confidence in their own ability can affect their interest, motivations and attitude towards a task.

Much past research has demonstrated that self-efficacy beliefs strongly mediate the effect of individuals’ skills on their performance and accomplishment by influencing the individuals’ effort and persistence in the face of adversity (Bandura, 1977; Jinks & Morgan, 1999; Schunk & Zimmerman, 2013; Zimmerman 1995; Zimmerman & Bandura, 1994). For example, a person’s self-efficacy beliefs have been found to influence the degree of effort they will expend on an activity, how long they will persevere when confronted with an obstacle or challenge, and their level of resilience when faced with adverse situations (Gore, 2006; Pajares, 2006; Wentzel & Wigfield, 1998; Wigfield & Eccles, 2000; Wigfield, Eccles & Rodriguez, 1998). According to Lopez (2012), unless a person believes that their actions can produce positive results, they have little incentive either to act or to persevere when faced with challenges.

Further, an individual's belief that their actions have the ability to produce a desired outcome can influence pessimistic or optimistic outlooks in a manner that can be self-hindering or self-enhancing (Lopez, 2012).

Bandura (1978) recognised the impact of the environment on people's self-efficacy when he developed his social cognitive theory, arguing that a person's environment is a force that shapes and controls the person's beliefs and behaviours. Bandura challenged Lewin's (1936) theory (discussed in Section 2.2.1), arguing that a person and their environment do not operate independently of each other but that, instead, the individual's behaviour, cognition, and environment are reciprocally interacting determinants that influence each other. Bandura (1978) developed a bidirectional three-way model (depicted in Figure 2.2) that illustrated the reciprocal relationships between behaviour, perceptions, and the external environment.

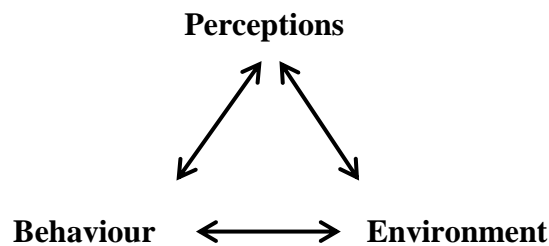


Figure 2.2. Bandura's (1978) bidirectional three-way model of interactions

Research by Bandura (1978) suggests that a person's environment (such as the classroom, as an academic environment) can influence their self-efficacy. According to his social cognitive theory, cognitive processes such as reflective thought play a part in determining how people observe, perceive, and value their environment and external events. Such cognitive processes also influence whether environmental and external events have lasting effects on people's efficacy, and how people organise the information conveyed for future use. People reflect upon these environmental and external influences and subsequently create and plan future actions or behaviour. Thus, "by altering their immediate environment, by creating cognitive self-inducements, and by arranging conditional incentives for themselves, people can

exercise some influence over their own behaviour” (Bandura, 1978, p. 345). Hence, Bandura’s research suggests that the efficacy that arises as a result of positive experiences in a particular environment can be both immediate and long-lasting.

People’s beliefs about their self-efficacy and abilities play a prominent role in the work of various motivation theorists. For example, Weiner (1985), in his attribution theory, proposed that a person’s self-belief in their ability has important motivational consequences. In their self-determination theory, Deci and Ryan (1985) asserted that self-efficacy and a feeling of self-confidence are basic human needs. Such competence beliefs develop as a result of people’s performance at previous tasks and the associated feedback received (for example, feedback that students receive from teachers; Wigfield et al., 1997).

In educational contexts, some studies propose that beliefs, self-efficacy, and attitudes to class and subject are directly and positively related to each other (Bandura, 1997; Demirtas, Comert, & Ozer, 2011). According to Pajares and Miller (1994), efficacy beliefs have the potential to influence emotional reactions such as anxiety and stress, which, in turn, often have negative impacts on students’ academic outcomes. Not only can efficacy impact on achievement (Boz et al., 2016) but, according to Westwood (2004), the reverse is also true: That is, an experience of success in a particular domain generates a feeling of positive self-efficacy.

Student self-efficacy in the educational context has been found to have important associations with student achievement (Aldridge, Afari, et al., 2012; Aldridge & Fraser, 2008; Baker & Wigfield, 1999; Bandura, 1997; Bouffard-Bouchard, Parent, & Larivee, 1991; Brady-Amoon & Fuertes, 2011; Galyon, Blondin, Yaw, Nalls, & Williams, 2012; Gore, 2006; Jinks & Morgan, 1999; Lorschach & Jinks, 1999; Louis & Mistele, 2011; Mettas, Karmiotis, & Christoforou, 2006; Pajares, 2006; Pajares & Schunk, 2001; Phan & Ngu, 2014; Spinath, Spinath, Harlaar, & Plomin, 2006; Wigfield & Guthrie, 1997; Zhang & Zhang, 2003; Zimmerman, 2000). Students who experience learning-related success are more likely to develop self-efficacy (Obach, 2003; Skaalvik & Valas, 1999); be intrinsically motivated (Gottfried, Fleming, & Gottfried, 2001; Skaalvik & Valas, 1999); have better perceptions of their academic competence (Gottfried, et al., 2001; Obach, 2003); and have lower levels of academic

anxiety (Gottfried, et al., 2001). Students with high self-efficacy are also likely to try to persevere with a variety of learning strategies (Jinks & Morgan, 1999). Conversely, if students do not have opportunities to develop self-efficacy through successful learning experiences, they may start to disengage from learning, even in the early school years (Finn & Rock, 1997). Students who doubt their abilities are more likely to give up on the learning process if their early efforts don't result in perceived success and a negative spiral of lower self-efficacy and achievement can ensue (Jinks & Morgan, 1999). Given this relationship between students' self-efficacy and achievement, it was considered important to incorporate self-efficacy into the study reported in this thesis.

The present study contributes to existing research in the field of self-efficacy by examining the impact of students' perceptions of the learning environment and their use of ICT within the classroom on their self-reports of self-efficacy. Much past research on similar topics has been conducted at the secondary (Bell & Aldridge, 2014; Gore, 2006; Velayutham & Aldridge, 2013) and tertiary levels of education (Aldridge, Afari, et al., 2012; Al Zubaidi et al., 2016; Brady-Amoon & Fuertes, 2011), but little research exists that has examined academic self-efficacy among primary school students (Jinks & Morgan, 1999). As such, the present research extends existing research by providing insights into students' self-reports of self-efficacy at a primary school level.

2.4.2 *Enjoyment*

The present study examined the associations between primary school students' perceptions of the learning environment and of the use of ICT in the classroom and the outcomes of self-efficacy and enjoyment (both of class and of the use of ICT). This section (Section 2.4.2) reviews literature pertinent to the final affective outcome of enjoyment.

Formal education can allow students not only to acquire cognitive skills and knowledge but also to experience either pleasant or unpleasant emotional outcomes related to learning and achievement (Frenzel, Goetz, Ludtke, Pekrun, & Sutton, 2009). Students' experiences of positive emotions in association with learning are

psychologically important as these emotions serve as markers of optimal well-being (Fredrickson, 2001). Balance between positive and negative emotions predicts a person's judgements about their own well-being, with positive emotions allowing individuals to flourish both in the moment and long term (Frederickson, 2001). Experiences of positive emotions motivate the individual to engage with their environment and in activities (Frederickson, 2001). In an educational setting, according to Vygotsky's (1978) sociocultural theory, positive emotions can impact on learning as—emotions, motivation, and learning are closely interconnected, with emotions being “important determinants of thinking and learning” (Schneider & Stern (2010, p. 81).

One positive emotion that can impact on students' well-being, motivation, and learning is enjoyment (Frenzel et al. 2009). Enjoyment is defined by Gomez, Wu, & Passerini (2010, p. 38), as the extent to which learning is “perceived to be pleasant and satisfactory to the learner”, for example, the positive emotions such as pleasure and fun that are generated by a learning experience. Enjoyment can be described as the good feelings one experiences when one engages in an activity that pushes them beyond what they could previously do (Csikszentmihalyi, 2014). Enjoyment is the experience of taking pleasure in something (Davis, 1982) and provides motivation for people to act or a reason for them to participate in a particular activity (Warner, 1980).

Enjoyment features in flow theory (Csikszentmihalyi, 1990), which describes the psychological state that people experience when they are engaged in the learning process. Flow describes the state of deep absorption in a given activity that is intrinsically enjoyable (Csikszentmihalyi, 1990). When individuals are in a state of flow, they perceive the activity they are engaged in and their performance of that activity to be successful and pleasurable—and thus the activity itself to be worth doing. The activity is found to be intrinsically rewarding and therefore individuals seek to replicate such flow experiences (Nakamura & Csikszentmihalyi, 2002; Shernoff, Csikszentmihalyi, Schneider, & Shernoff, 2003). Enjoyment is a crucial prerequisite in order for people to experience flow (Csikszentmihalyi, 1997). Flow activities that are enjoyable, in turn, generate feelings of satisfaction and accomplishment (Shernoff et al., 2003). As such, experiencing enjoyment is important for students' engagement in learning activities.

Although it is widely argued that research into student emotions (such as enjoyment) has been neglected by researchers (see, for example, Boekaerts, 2001; Frenzel et al., 2009; Linnenbrink, 2006; Meyer & Turner, 2007; Pekrun, Goetz, Titz, & Perry, 2002; Pekrun & Stephens, 2011), enjoyment has been increasingly referred to by policy makers as a key goal of education (Bailey, 2009; Lumby, 2011). This increase suggests policy makers' acknowledgement that enjoyment is vital in relation to learning (Lumby, 2012).

Existing research suggests that enjoyment is positively related to motivation and achievement (see, for example, Ashby, Isen, & Turken, 1999; Frenzel et al., 2009; Pekrun & Stephens, 2011; Pekrun et al., 2002; Pekrun, Goetz, Frenzel, Barchfeld, & Perry, 2011). In one study by Pekrun et al. (2002), a high correlation was identified between student enjoyment and motivation. Further, Pekrun et al.'s (2002) results suggested that academic enjoyment predicted high achievement. Research by Blunsdon, Reed, McNeil, and McEachern (2003) suggested that students perceive that they have learnt more from a particular activity when they have enjoyed the activity; the same research also confirmed that a positive relationship exists between students' perceptions of their learning, enjoyment of learning, and learning outcomes. Other enjoyment studies have shown that positive emotions such as enjoyment promote resilience, self-regulation, and problem solving among students (Fredrickson, 2001; Pekrun, 2006; Pekrun et al., 2002) and enhance students' interest and the willingness to re-engage in learning activities over time (Hidi & Renninger, 2006; Schiefele, 1991). As such, students' experiences of enjoyment in their learning environment can have important associations with motivation and achievement.

The present study examined students' self-reports of their enjoyment of their class and their enjoyment of using ICT. To inform this examination, the following sections review literature specifically related to these two areas: enjoyment of class (Section 2.4.2.1) and enjoyment of using ICT (Section 2.4.2.2).

2.4.2.1 Enjoyment of Class

The research described in the previous section (Section 2.4.2) indicates that relationships exist between enjoyment and student achievement. Given that the

classroom is the environment in which student learning occurs, the extent to which students find learning to be enjoyable within a given classroom is likely to have important associations with learning and achievement. The higher the students' perceived enjoyment of the overall learning experience within the classroom, the deeper their involvement in learning, resulting in higher learning outcomes (Gomez et al., 2010).

When people find learning activities pleasurable, they may choose to engage more fully in learning. This choice can be referred to as academic intrinsic motivation, which describes the participation in learning for its own sake, as a result of the pleasure inherent in the learning activity (Deci & Ryan, 1985; Eccles, Wigfield, & Schiefele, 1998; Gottfried et al., 2001; Wigfield & Eccles, 2000). Hence, learning can be promoted in the classroom if students are able to engage in enjoyable tasks, as this can result in increased motivation to learn (Spinath & Spinath, 2010). Given the importance of students' enjoyment of their class for student learning, the present study aimed to investigate the relationship between the classroom environment in which learning occurs (including the use of ICT within the classroom) and students' self-reports of their enjoyment of class.

Students' enjoyment of the classroom environment was selected as an important affective outcome to investigate in the present study based on the associations revealed in past research. For example, research by Bell and Aldridge (2014) suggested that statistically significant and positive relationships exist between the classroom learning environment and student enjoyment. A further range of research exists that outlines the relationship between enjoyment, interest, and participation in the classroom (Ainley & Ainley, 2011; Fredrickson, 2001; Seligman & Csikszentmihalyi, 2000). Enjoyment of a class is important to students' participation in learning activities, as students may lose interest and disengage if a learning activity does not produce feelings of enjoyment (Ainley & Ainley, 2011). As a result, enjoyment of class can be linked to high levels of task engagement (Ainley & Ainley, 2011; Fredrickson, 2001) and is important to learning.

Given that past studies have revealed associations between students' enjoyment of their class and educational achievement, it was considered important for the present

study to investigate the relationships among students' perceptions of the learning environment, their perceptions of the use of ICT in the classroom, and the affective outcome of students' enjoyment of class.

2.4.2.2 Enjoyment of Using ICT

Whereas the previous section (Section 2.4.2.1) reviewed literature related to students' enjoyment of class, the following section (Section 2.4.2.2) reviews literature related to students' enjoyment of using ICT. Past research indicates that the use of ICT can be perceived by students as intrinsically motivating and enjoyable in its own right (Deci & Ryan, 2000; Maiano, Therme, & Mestre, 2011; Venkatesh, Morris, Davis, & Davis, 2003; Lee et al., 2015; Zaman, Anandarajan, & Dai, 2010). Further, Agarwal and Karahanna (2000) developed the construct of cognitive absorption in relation to technology, whereby ICT users can become intrinsically motivated by a task, be engrossed in the experience, and enter a state of deep attention and involvement. Therefore, some research suggests that the use of ICT within the classroom may contribute to feelings of enjoyment among students.

The effective integration of ICT has the potential to enhance students' enjoyment of and engagement in learning by allowing students to be agents of their own learning. The use of ICT in learning activities deviates from the traditional teaching method (transferring knowledge from teacher to student) by allowing students to construct their own knowledge; this provides opportunities for students to be more active learners (Gomez et al., 2010; Wu, Bieber, & Hiltz, 2009). With the use of ICT, students can control the pace of their own learning and exchange ideas and opinions with a variety of sources such as peers and teachers (Gomez et al., 2010). When the integration of ICT into instruction results in students' perceiving learning to be more enjoyable, there is greater potential for deep student involvement in learning which, in turn, can result in higher learning outcomes (Gomez et al., 2010). Given this evidence, the present study aimed to investigate the relationships between the learning environment, the use of ICT within that learning environment, and students' enjoyment of using ICT.

This section (Section 2.4.2) reviewed literature related to the student outcome of enjoyment (of class and of using ICT). The following section (Section 2.4.3) reviews existing instruments related to the assessment of the student outcomes relevant to the present study, namely, self-efficacy and enjoyment.

2.4.3 Existing Instruments Related to Student Self-Efficacy and Enjoyment

Overall, the review of research outlined in Section 2.4.1 and Section 2.4.2 has found that the affective outcomes of student self-efficacy, enjoyment of class, and enjoyment of using ICT have important associations with learning and achievement (Aldridge & Fraser, 2008; Ashby et al., 1999; Bandura, 1977; Frenzel et al., 2009; Jinks & Morgan, 1999; Pekrun & Stephens, 2011; Pekrun et al., 2002; Pajares & Schunk, 2001; Spinath et al., 2006; Wigfield & Guthrie, 1997; Zimmerman, 2000) and, further, that these affective outcomes can be shaped and influenced by external factors such as the learning environment (Galloway, Rogers, Armstrong, & Leo, 1998; Paris & Turner, 1994). This body of research suggests that if teachers can identify ways to effectively motivate and engage students through generating feelings of self-efficacy and enjoyment, these affective emotions will ultimately impact upon student learning. As a result, it was considered to be important to incorporate these affective outcomes (self-efficacy, enjoyment of class, and enjoyment of ICT) in the present study.

Although much research has highlighted the importance of students' self-efficacy, enjoyment of class, and enjoyment of using ICT, instruments to measure these three affective outcomes are largely lacking (Pekrun, Goetz, Frenzel, Barchfeld, & Perry, 2011), particularly for use at the primary school level. As such, the present research extends the existing research in this field through the development of a new survey to examine the relationships between primary school students' perceptions of their learning environment and their use of ICT in the classroom and students' self-efficacy and enjoyment (of class and ICT use).

A review of existing instruments in the field of student self-efficacy and enjoyment revealed a number of studies in the area of student motivation which included a single self-efficacy scale such as the Motivated Strategies for Learning Questionnaire (Pintrich, Smith, Garcia, & McKeachie, 1991), the Patterns of Adaptive Learning

Survey (Midgley et al., 1996), the Students' Motivation Towards Science Learning survey (Tuan, Chin, & Shieh, 2005) and the Science Motivation Questionnaire (Glynn, Taasobshirazi, & Brickman, 2009). However, each of these instruments were precluded from the present study as they were developed for the university level and contained complex sentence structures and terminology which would not be suitable for primary students. Several of these instruments also contained negatively worded items. For example, the self-efficacy scale in the Students' Motivation Towards Science Learning survey contained five out of seven items which were negatively worded, proving too difficult for primary students and compromising to face validity. The College Self-Efficacy Inventory developed by Solberg, O'Brien, Villareal, Kennel, and Davis (1993) was precluded from the present study as it was designed to measure specifically the self-efficacy of Hispanic college students.

The following sections review several instruments in the field of self-efficacy and enjoyment which are related to the present study; the Morgan-Jinks Student Efficacy Scale (MJSES; Section 2.4.3.1), the Achievement Emotions Questionnaire (AEQ; Section 2.4.3.2) the Students' Adaptive Learning Engagement in Science Questionnaire (SALES; Section 2.4.3.3), the Engagement in English Language Learning and Self-Regulation (EELLS) survey (Section 2.4.3.4) and the Attitudes and Self-Belief Survey (ASBS; Section 2.4.3.5).

2.4.3.1 Morgan-Jinks Student Efficacy Scale (MJSES)

The Morgan-Jinks Student Efficacy Scale (MJSES; Jinks & Morgan, 1999) was designed to gather information about student efficacy beliefs in relation to academic performance from primary school students. The original version of the scale included four subscales, namely talent, effort, task difficulty, and context and included 53 items in total. Items used a Likert-scale response format using the informal alternatives of *really agree*, *kind of agree*, *kind of disagree*, and *really disagree*. The scale also incorporated self-reported grades as a variable which was acknowledged by the authors as not a perfectly accurate measure.

Factor analysis following three field tests resulted in the task difficulty subscale being lost and item-analysis resulted in several items with a correlation below 0.30 being

dropped. The final scale included thirty items within the three subscales. Results revealed that students who expressed high self-efficacy beliefs also reported higher grades, indicating a moderately positive correlation between self-efficacy and achievement. Jinks and Morgan (1999) suggest that self-efficacy doesn't directly affect student outcomes but leads to positive behaviours which in turn contributes to achievement.

Whilst the MJSES was developed for primary school students, it was not considered as an appropriate tool for the present study. The main reason was because, conceptually, the MJES was problematic in terms of whether it assess students' perceptions of their school or their class and included items that did both. For example the wording of one item is, *I go to a good school*. Also, the MJSES had a significant focus on student achievement grades (performance goal orientation), with seven items incorporating student perceptions about their own grades including in relation to the grades of other students such as *My classmates usually get better grades than I do* and *I could get the best grades in class if I tried enough*. Given that performance goal orientation was not an objective of this study, and was deemed to be inappropriate for the Western Australian primary context. Given that primary students generally only receive an A – E grade for a subject twice a year in their end of semester report and as a result, students would not always be aware of the grades received by their peers.

2.4.3.2 Achievement Emotions Questionnaire (AEQ)

Developed by Pekrun et al. (2011), the Achievement Emotions Questionnaire (AEQ) was constructed to assess achievement emotions experienced by students in academic environments. The questionnaire incorporates scales for nine emotions, namely enjoyment, boredom, and anger (activity emotions), hope, anxiety, and hopelessness (prospective outcome emotions) and shame, relief, and pride (retrospective outcome emotions). A five-point Likert-scale response format is used ranging from 1 (*completely disagree*) to 5 (*completely agree*). The instrument consists of 24 scales and 232 items with 10 items specifically related to enjoyment. Sample items related to enjoyment include *I enjoy being in class* and *I enjoy acquiring new knowledge*. Internal and external validity measures based on implementation with a sample of 389 Canadian university students indicated reliability and validity of the AEQ however

this instrument was precluded from use in the current study as it was designed for university students.

2.4.3.3 Students' Adaptive Learning Engagement in Science Questionnaire (SALES).

The Students' Adaptive Learning Engagement in Science (SALES) questionnaire was developed by Velayutham, Aldridge, and Fraser (2011) to measure contributing factors to the motivation and self-regulation of students in lower secondary science classrooms. The SALES focused on psychosocial features of the learning environment that influence students' motivation and self-regulation in order to develop 32 items within four scales, namely, Learning Goal Orientation, Task Value, Self-efficacy, and Self-regulation of Effort. The questionnaire incorporated a five-point response scale: *strongly disagree, disagree, not sure, agree, and strongly agree* (Velayutham et al., 2011). Typical items are *What I learn is relevant to me* (task value scale) and *I can master the skills that are taught* (self-efficacy scale). The SALES was validated as a reliable tool for use in Australian secondary science classrooms (Velayutham et al., 2011; Velayutham & Aldridge, 2013).

The SALES instrument was determined to be inappropriate for use in the present study as it was developed for secondary students and uses some terminology that would be difficult for primary aged students to comprehend such as *I can understand the contents taught*. In addition to this, many items specifically focus on the science learning area and only one scale, self-efficacy, was relevant to the requirements of the present study.

2.4.3.4 Engagement in English Language Learning and Self-Regulation (EELLS) survey.

The Engagement in English Language Learning and Self-Regulation (EELLS) survey was developed by Al Zubaidi et al. (2016) to investigate the influence of learning environment perceptions on students' motivation and self-regulation in learning English as a second language. The instrument was validated for use with 994 Jordanian university students, assessing their motivation and self-regulation in English language classes. The EELLS was adapted from the SALES and includes four scales: Self-

efficacy, Self-regulation, Learning goal orientation and Task value. The original version of the EELLS contained 32 items, however seven items were found to be problematic and were omitted, leaving the final version with 25 items within the four scales. The response scale utilised a five-point Likert-type scale.

The results of factor structure; internal consistency reliability; discriminant validity; and differential analyses provided strong support for the reliability and validity of the EELLS. However, this instrument was not a valid option for use in the present study for two reasons. First, items within the EELLS were constructed for suitability within the Jordanian context and second, the survey was designed for use with university students for whom English was a second language. Hence, the EELLS was not suitable for use within the context of Australian primary school classrooms.

2.4.3.5 *The Attitudes and Self-Belief Survey (ASBS)*

The Attitudes and Self-Belief Survey (ASBS) was developed by Bell and Aldridge (2014), for use in Western Australian secondary classrooms, to assess students' attitudes towards learning in given subject area. The development of this instrument was based on a survey initially developed by Aldridge and Fraser (2008) used to assess student attitudes in an outcomes-based classroom. The initial version of the ASBS included two eight-item scales (Student Enjoyment and Academic Efficacy). The final version of the ASBS is a 14 item, two-scale survey with seven items in each scale (renamed Attitude to Subject and Academic Efficacy). The response format of the ASBS utilised a five-point frequency scale consisting of *almost always*, *often*, *sometimes*, *seldom*, and *almost never*.

Factor analysis, internal consistency reliability, and discriminant validity measures provided strong support the reliability and validity of the ASBS. The administration of the ASBS by Bell and Aldridge (2014), was conducted in conjunction with the administration of the COLES. As a result, two-tailed Pearson coefficient was examined to assess the predictive validity of the COLES scales and the ASBS scales (Student Enjoyment and Academic Efficacy). That is, associations between the learning environment and student attitudes. These results suggested that all COLES scales statistically significantly correlated with each of the two ASBS scales.

As illustrated above, few surveys exist which focus specifically on self-efficacy and enjoyment and even less have been validated for use in the primary classroom. No instruments were found to measure student perceptions related to enjoyment of ICT use in the classroom. The ASBS was identified as a reliable tool developed for use in the Western Australian secondary education context which assessed student self-reports of self-efficacy and enjoyment. It showed good predictive validity with the COLES scales and incorporated the same response scale as the COLES. Given the strong reliability of the ASBS and the applicability of the Academic Efficacy and Attitude to Subject scales to the research reported in this thesis, these two ASBS scales determined to be suitable for modification for primary school students. The use of the ASBS to develop the new survey instrument is described further in Chapter 4 (Section 4.4). The present study will contribute to the field of learning environments by developing and validating survey instruments relevant to the Western Australian context for assessing primary school students' perceptions of the learning environment and the subsequent impact on the student outcomes of self-efficacy and enjoyment.

This section (Section 2.4) has examined literature related to the affective outcomes of student self-efficacy and enjoyment (of class and ICT use), as key constructs within this study and important outcomes related to the learning environment and use of ICT within the classroom. This section (Section 2.4) also reviewed existing instruments related to student engagement and enjoyment. When examining student perceptions of the learning environment and these important affective outcomes (self-efficacy, enjoyment of class, and enjoyment of using ICT), it is important to consider the characteristics of groups of students. As such, the following sections examine literature related to the differences that exist between male and female students' perceptions of the learning environment (Section 2.5) and the differing perceptions of at-risk students compared to those of students who are not at risk (Section 2.6).

2.5 Gender Differences

The effects of a learning environment on students can be described as reciprocal: students affect their learning environment just as their environments impact on them (Shonkoff & Phillips, 2000). In addition, no two children experience their environment in exactly the same way (Shonkoff & Phillips, 2000). It is expected, therefore, that

different students' perceptions of the same learning environment may differ. As such, the present study examined whether gender differences exist within students' perceptions of their learning environment and use of ICT and their self-reports of self-efficacy, enjoyment of class, and enjoyment of using ICT (research objective 5).

To inform this examination, this section (Section 2.5) reviews literature in relation to gender perception differences in educational settings. First, literature related to differences in learning environment perceptions according to gender is reviewed (Section 2.5.1). Second, research related to differences in perceptions of the use of ICT within the classroom according to gender is examined (Section 2.5.2). Finally, literature related to differences in students' self-reports of affective outcomes (self-efficacy, enjoyment of class, and enjoyment of using ICT) according to gender is reviewed (Section 2.5.3).

2.5.1 Gender Differences in Students' Perceptions of the Learning Environment

Research related to gender perception differences in terms of the learning environment indicates mixed results. Although some studies have indicated that gender differences in learning environment perceptions are negligible (see, for example, Aleamoni, 1999 and Lim, 1995), many studies have documented such gender differences and consistent trends can be identified across such studies (Sinclair & Fraser, 2002; Wong & Fraser, 1995). Much literature related to gender differences in student perceptions of learning environments around the world at different education levels has found that female students tend to perceive the learning environment more favourably than male students. At the high school level, studies have found that, in general, female students perceive more positive classroom environments than males; this trend has been observed in Australia (Aldridge & Fraser, 2008; Chipangura & Aldridge, 2017); Bhutan (Tshewang et al., 2017); Brunei Darussalam (Majeed et al., 2002); Canada (Klassen, 2010); Indonesia (Wahyudi & Treagust, 2004); the Netherlands (den Brok et al., 2006); Oman (Alkharusi, Aldhafri, Alnabhani, & Alkalbani, 2014); and Turkey (Boz et al., 2016). Fewer studies have been conducted outside of secondary school settings; however, at the tertiary level in Turkey, the results of a study by Kaya, Ozay and Sezek (2008) suggested that female students perceive the learning environment more positively than male students. Similarly, at the primary school level, a study

conducted in Singapore by Goh and Fraser (1998) using their QTI, found that the same trend existed.

Relatively few studies have examined gender differences in learning environment perceptions at the primary school level. Whereas the study (mentioned above) by Goh and Fraser (1998) reported results of male and female students' perceptual differences at the primary school level, these results were specifically in relation to the learning area of mathematics. Two previous studies that were found to have investigated gender perception differences more broadly within the primary school learning environment are reviewed below.

First, Sinclair and Fraser (2002) developed the Elementary and Middle School Inventory of Classroom Environments and use this instrument to examine actual-preferred differences in the gender perceptions of grade 6 to 8 students in relation to the learning environment in Texas. In general, the results of Sinclair and Fraser's (2002) research indicated that females perceived learning environments more positively than their male counterparts. Specifically, statistically significant differences were identified between gender scores for cooperation and teacher empathy, with females having more positive perceptions of both constructs. However, males and females had equal perceptions of task orientation and involvement. Overall, Sinclair and Fraser's study provides partial support at the primary school level for the trend identified in the previous international studies referred to above.

Second, using scales from CLES (Aldridge, Fraser, Taylor, & Chen, 2000; Taylor et al., 1997), the WIHIC (Aldridge et al., 1999), and the Test of Science Related Attitudes (TOSRA; Fraser, 1978), Peer and Fraser (2015) examined gender differences in learning environment perceptions and attitudes to science as part of a study in Singaporean primary school science classrooms. Significant gender differences were found in students' perceptions related to involvement, teacher support, task orientation, and cooperation. However, the effect sizes for these differences were small, suggesting that the gender differences were of minor educational significance. Overall, males were found to have higher mean scores for five of the eight learning environment scales: involvement, investigation, personal relevance, uncertainty, and

student negotiation; females perceived higher levels of teacher support, task orientation and cooperation than their male counterparts.

Past research into gender perceptual differences in relation to the learning environment is inconclusive and few studies have investigated such perceptions at a primary school level. The present study aimed to contribute to this field of research by examining whether primary school students report gender differences in relation to perceptions of the learning environment. This section (Section 2.5.1) examined literature related to differences in student gender perceptions of the learning environment. The following section (Section 2.5.2) examines literature related to differences in student gender perceptions in terms of ICT use in the classroom.

2.5.2 Gender Differences in Students' Perceptions of the Use of ICT within the Classroom

Few past studies were able to be located that related to gender differences in students' perceptions of the use of ICT within the classroom. Those studies that were found are reviewed in this section (Section 2.5.2).

Overall, past studies examining gender differences in students' perceptions of the use of ICT in the learning environment have yielded mixed results. However, the majority of these studies have examined students' perceptions according to gender in terms of using ICT in online learning environments. For example, the studies by Lu and Chiou (2010) and Ong and Lai (2006) have suggested that male students have more positive perceptions of using ICT to learn in an online learning environment than female students. However, similar research by González-Gómez, Guardiola, Rodríguez, and Alonso (2012) indicated that the reverse was true. Still other researchers have suggested that gender has no effect on either students' attitudes toward the use of ICT for online learning (Cuadrado-García, Ruiz-Molina, & Montoro-Pons, 2010; Hung, Chou, Chen, & Own, 2010) or students' outcomes related to using ICT to learn online (Chu, 2010). Hence, this specific line of research (into online learning environments) does not give a definitive indication about whether differences in student gender perceptions exist.

Whereas the studies reviewed in the previous paragraph examined students' perceptions according to gender of using ICT in online learning environments, the current study examines students' perceptions of the use of ICT in traditional primary school classroom settings. Only six prior studies were able to be located that examine this issue in traditional primary school classrooms which, again, provide conflicting results. Research by Bolliger and Supanakorn (2011) and Schroeder and Adesope (2015) suggested that no gender differences exist in student perceptions of the use of ICT in the classroom. However, studies by Snell (2012) and Wehrwein, Lujan, and DiCarlo (2007) indicated that males had more positive attitudes towards using technology in the classroom than females, and research by Bain and Rice (2007) suggested that male students display higher levels of confidence and interest in technology use than their female counterparts. Finally, research by Koul et al. (2011) suggested that female students had more favourable perceptions of a technology-rich classroom than male students.

Overall, this section (Section 2.5.2) has indicated that past studies into gender perpetual differences in relation to ICT use within learning environments (whether online- or classroom-based) are few in number and yield conflicting results. As such, the present study aimed to build on this body of research by providing a further investigation of whether gender differences exist in primary school students' perceptions related to their use of ICT in the learning environment. The following section (Section 2.5.3) examines literature related to differences in gender perceptions in terms of students' self-reports of self-efficacy, enjoyment of class, and enjoyment of using ICT.

2.5.3 Gender Differences in Students' Self-Reports of Affective Outcomes (Self-efficacy, Enjoyment of class, and Enjoyment of using ICT)

This section (Section 2.5.3) reviews literature related to gender perceptual differences in students' self-reports of affective outcomes. The affective outcomes included in the present study were student self-efficacy and student enjoyment (of class and ICT use).

In terms of gender differences in student self-efficacy, some studies suggest that differences exist. For example, research by Dorman and Fraser (2009) and Fischer,

Schult, and Hell (2013) indicated that male students had higher levels of self-efficacy than female students. A study by Spinath, Spinath, and Plomin (2008) suggested that male students had higher perceptions of their abilities, particularly in mathematics, than female students. Other studies have documented that female students have lower levels of self-efficacy associated with the use of ICT than their male counterparts (Broos, 2005; Broos & Roe, 2006; Durndell & Haag; 2002; Laosethakul, Leingpibul, & Coe, 2012).

In contrast, other studies have indicated that self-efficacy does not vary according to gender (see, for example, Britner & Pajares, 2006; Kiran & Sungur, 2012; Snell, 2012; Usher & Pajares, 2006). As Boz et al. (2016) noted, although overall, no significant relationship existed in the results of their study between gender and student self-efficacy, females' more favourable perceptions of their learning environment led them to have higher academic self-efficacy than their male counterparts.

The second affective outcome examined in the present study was students' enjoyment (in relation to both their class and their ICT use). Few studies were found to exist that investigated student enjoyment, particularly at the primary school level. However, one study by Peer and Fraser (2015) suggested that male students perceived higher levels of enjoyment (in science classes) compared to females. Further, a study conducted at the tertiary level by Pekrun et al. (2011) indicated that female psychology students reported higher levels of enjoyment of class than their male counterparts. However, the effect size for this gender difference was small, suggesting minimal educational importance.

Much of the past research related to gender differences and enjoyment outcomes has been conducted with reference to particular subject areas. For example, Frenzel, Goetz, Pekrun, and Watt (2010) found that females had lower levels of interest and enjoyment in mathematics than their male counterparts. Research by Lindberg, Hyde, Petersen, and Linn (2010) and Chen, Yang, and Hsiao (2016) support this finding, yet showed that despite this attitudinal difference, both genders perform equally in mathematics. According to Vandecandelaere, Speybroeck, Vanlaar, De Fraine, and Van Damme (2012), male students value mathematics more than female students but enjoy mathematics less than their female counterparts. Several studies have suggested

that female students have lower levels of interest in and enjoyment of science than male students (Buccheri, Gürber, & Brühwiler, 2011; Fischer et al., 2013; Hannover & Kessels, 2006; Miller, Slawinski Blessing, & Schwartz, 2006).

Few studies exist that have examined gender differences in primary school students' perceptions of affective outcomes. It is possible that this lack of research may be attributed to a perception that few differences exist between the attitudes (such as enjoyment) of males and females at the primary school level and that gender differences are more likely to manifest in secondary school (Alexakos & Antoine, 2003; Wolf & Fraser, 2008). Other research, however, suggests that gender-typical interests develop in individual children at a young age, (Buccheri et al., 2011; Chen & Darst, 2002), suggesting that it is important to examine gender perceptual differences of primary school students in the present study. As such, the present study extends past research by investigating whether gender differences do exist between students' self-reports of self-efficacy and enjoyment (of class and ICT use) at the primary school level.

Overall, the review of literature outlined in this section (Section 2.5) suggests that few past studies have investigated gender differences in students' perceptions of the learning environment and their use of ICT or students' self-reports of affective outcomes. This conclusion is supported by Chen et al. (2016), who suggest that differences in gender perceptions of the learning environment are relatively unexplored. The research into differences in student gender perceptions that does exist shows mixed results. This lack of research is particularly acute at the primary school level. Therefore, the present study aimed to contribute to the field by examining the gender differences that exist at the primary school level between students' perceptions of their learning environment, students' perceptions of their use of ICT, and the student outcomes of self-efficacy and enjoyment (of class and using ICT). The following section (Section 2.6) reviews the literature related to at-risk students (in relation to research objective 6).

2.6 At-Risk Students

Given that individual children experience their environment in different ways (Shonkoff & Phillips, 2000), research objective 6 in the present study examined whether perceptions of the learning environment differed between students who were considered to be academically at risk and those who were not at risk. For the purposes of this study, at-risk students are defined as those students who are performing at or below the benchmark in their year 3 or year 5 reading, writing, and/or numeracy National Assessment Program Literacy and Numeracy (NAPLAN) tests. That is, at-risk students are those who are not achieving the expected learning outcomes for their year level. Further details about the identification of at-risk students can be found in Section 3.4.4.

This section (Section 2.6) reviews literature related to students who experience learning difficulties and are not achieving the expected academic outcomes for their age group. In particular, this section examines the associated risks for these students in terms of their educational achievement and life outcomes. This section also considers the use of ICT within the classroom as a means to enhance the learning of academically at-risk students.

The concept of being at risk relates to the notion that “exposure to particular conditions, or risk factors, increases the likelihood that an individual will experience certain adverse consequences” (Finn & Rock, 1997, p. 221). Children who fail to reach academic milestones in early year levels usually continue to perform poorly in subsequent years (Cunningham & Stanovich, 1997), potentially producing an ongoing poor achievement throughout schooling. Academic difficulty is a well-established risk factor and students experiencing academic difficulty are considered to be in danger of school failure (Finn & Rock, 1997).

A range of negative outcomes can potentially be experienced by students who are academically at risk. Students who are academically at risk evidence difficulties with learning and, as such, may be more likely to experience lower academic self-efficacy than their peers (Baird, Scott, Dearing, & Hamill, 2009; Hen & Goroshit, 2012; Klassen, 2010; Westwood, 2004). Moreover, these at-risk students’ low self-efficacy

can translate into a diminished capacity for learning challenging academic curricula, which can, in turn, limit progress (Baird et al., 2009). Further research suggests that students who are academically at risk have higher rates of absenteeism (Finn & Rock, 1997; Westwood, 2004); exhibit increased behaviour problems (Farkas, Grobe, Sheehan, & Shuan, 1990; Finn & Rock, 1997; McFadden, Marsh, Price, & Hwang, 1992; Sabornie & deBettencourt, 2004); set lower achievement goals (Baird et al., 2009); have lower levels of motivation (Baird et al., 2009); participate less fully in learning activities (Finn, Panno, & Voelkl, 1995; Finn & Rock, 1997; Lamborn, Brown, Mounts, & Steinberg, 1992); have less persistence (Baird et al., 2009); exhibit lower levels of enjoyment (Baird et al., 2009); and do not perform as well as students who do not have learning difficulties (Baird et al., 2009). Brophy (1983) suggested that students who are academically at risk can lose their motivation to persist with learning due to their experiences of frustration and failure and this loss of motivation can, in turn, lead to underachievement.

The risks described above, that are attributed to academically at-risk students, can potentially result in more serious outcomes later in life. Lagana-Riordan et al. (2011) suggest that students who do not succeed in educational settings are more likely to experience depression, drug and alcohol abuse, violence, and incarceration later in life.

Some past research has suggested that associations exist between the learning environment and the learning outcomes of academically at-risk students. For example, many students considered to be academically at risk have named poor teacher relationships and the detrimental effect of negative peer behaviours (such as teasing) as major contributors to their lack of success (Lagana-Riordan et al., 2011). Barlow (1991) and San Martin and Calabrese (2011) identified that a positive learning environment is crucial for enhancing the learning of students who are academically at risk, and Finn and Rock (1997) suggest that participation, engagement, and involvement are the keys to academic success for such students. Given these indications from past research, the present study examined the perceptions of academically at-risk students in relation to their learning environments.

Technology can be a useful instructional tool to support academically at-risk students (Westwood, 2004). The use of ICT can provide a variety of individualised strategies

that assist teachers to meet the specific learning needs of academically at-risk students (Kennedy & Deshler, 2010; Seo & Bryant, 2009; Westwood, 2004). The use of technology can also engage and motivate academically at-risk students (Day, 2002) and allows learners to work at their own pace, making it easier to cater for individual learners' needs (Chipangura & Aldridge, 2017). The instructional principles and features of computer-assisted instruction—such as the provision of immediate corrective feedback and the ability to adjust task difficulty—are important factors related to the positive academic outcomes of students (Ayers & Gray, 2013; Chipangura & Aldridge, 2017; Clark, 1983). Multimedia tools provide the means for at-risk students to present their learning and express ideas in various multimodal ways depending on their strengths, interests, and skills (Hall, Cohen, Vue, & Ganley, 2015), which can assist such students to internalise learning (Kennedy & Deshler, 2010). As a result of the benefits outlined above, the use of ICT to assist with the instruction of academically at-risk students has become a widespread classroom practice (Ayers & Gray, 2013; Bryant & Bryant, 1998; Seo & Bryant, 2009; Westwood, 2004; Woodward & Carnine, 1993).

In addition to supporting the different learning styles of academically at-risk students, the use of ICT within the learning environment has been found to enhance academic and affective outcomes in at-risk students. In relation to the associations between ICT use and at-risk students' academic outcomes, a meta-analysis by Swanson (1999) of intervention methods for students with learning difficulties indicated that computer-assisted instruction had a moderately successful effect size of 0.52 standard deviations for improving student learning. Other research has suggested that the use of ICT in the classroom can support the development of a variety of literacy and numeracy skills (Ayers & Gray, 2013). Several researchers purport that the integration of technology in the classroom can potentially narrow the achievement gap of at-risk students (Kidd & Keengwe, 2012; Kulik, 2003; Magolda, 2006; Sabale, 2015). In terms of the relationship between ICT and the affective outcomes of at-risk students, past research has suggested that computer-assisted learning can give academically at-risk students a sense of control, empowerment, and motivation related to their learning (Ayers & Gray, 2013). Overall, given the associations that previous research has identified between the use of ICT and the academic and affective outcomes of at-risk students,

it was considered important to investigate the perceptions of academically at-risk students related to these variables in the present study.

This section (Section 2.6) has shown that academically at-risk students have the potential to experience negative affective outcomes and poor academic success as a result of their needs not being met within the classroom. Lagana-Riordan et al. (2011) demonstrated that academically at-risk students were capable of giving valuable feedback that could enhance their learning environment; as such, it is important that the perceptions of at-risk students in relation to their learning environment are considered to ensure that teachers are able to structure the environment to cater for these students, potentially mitigating some of the risks outlined above. Given these findings, the process of obtaining student perceptual feedback about the learning environment was considered to be important for the present study as this process involves benefits that may be amplified for students who are academically at-risk.

It is important for teachers to consider the impact of the learning environment on academically at-risk students as the classroom environment has the potential to exacerbate existing difficulties associated with learning for these students (Westwood, 2004). If teachers fail to ensure that the learning environment effectively serves students who are experiencing difficulties, then the most vulnerable students may be alienated (Helf, Cooke, & Flowers, 2009). Although Lagana-Riordan et al. (2011) have found that at-risk students are able to offer insightful and practical recommendations for the improvement of the classroom environment, research that elicits these student perceptions is lacking. The research reported in this thesis fills this gap by examining whether academically at-risk students' perceptions of the learning environment and the integration of ICT in the classroom, as well as these students' self-reports of affective outcomes (self-efficacy, enjoyment of class, and enjoyment of ICT), differ from those of students who are not similarly at risk.

2.7 Chapter Summary

This chapter has provided a review of literature related to the present study. Given that the present research draws on and extends the field of learning environments, this chapter began by reviewing seminal literature in this field and several existing learning

environment instruments (Section 2.2). Overall, this overview of the research field revealed a lack of learning environment instruments designed for use at the primary school level. Based on the findings of this review, the COLES was selected to form the basis of one of the instruments that were subsequently developed for the purpose of this study. The study reported in this thesis builds on the current body of research by developing and validating three new instruments to assess students' perceptions of the learning environment, use of ICT and self-reports of affective outcomes (self-efficacy, enjoyment of class, and enjoyment of using ICT) in the primary school setting.

Section 2.3 reviewed literature related to the use of ICT to enhance learning. This was followed by a review of the literature related to student self-efficacy and enjoyment (Section 2.4). Each of these reviews revealed gaps in research, particularly related to primary school students; the present study aimed to fill these gaps.

Given that the present study examined differences in the perceptions of male and female students, Section 2.5 reviewed literature related to gender differences in student perceptions of learning environments and the use of ICT, as well as in relation to students' self-reported affective outcomes. These reviews revealed mixed results in terms of whether the perceptions of male and female students differ.

Finally, the literature related to academically at-risk students was reviewed in Section 2.6, given that these students are a focus of the present study. The literature reviewed in this section indicated that negative associations exist between the perceptions of academically at-risk students in terms of the learning environment and academic and affective outcomes.

Overall, the literature review provided in this chapter reveals a lack of research at the in the fields of learning environments, classroom integration of ICT, student affective outcomes, gender differences in student perceptions, and the perceptions of at-risk students. Each of these research shortages was particularly apparent at the primary school level. The present study aimed to add to the existing literature through the assessment of primary school students' perceptions of their learning environment and their use of ICT in the classroom as well as their self-reports of self-efficacy and

enjoyment (of class and using ICT). The present study also examined whether these perceptions differed according to gender or for academically at-risk and not at-risk students. The following chapter (Chapter 3) reports the research design and methodology of the present study.

RESEARCH DESIGN AND METHODS

3.1 Introduction

Whereas Chapter 2 provided a review of literature related to the present study, this chapter describes the research design and methods utilised. The methods are detailed using the following headings:

- Research objectives (Section 3.2);
- Use of perceptual measures: Rationale (Section 3.3);
- Sample (Section 3.4);
- Instruments used for data collection (Section 3.5);
- Data analysis (Section 3.6);
- Ethical considerations (Section 3.7); and
- Chapter summary (Section 3.8).

3.2 Research Objectives

The study described in this thesis investigated six research objectives that were introduced in Chapter 1. These research objectives are reiterated below.

Research Objective 1

To develop and validate three surveys to assess primary school students’:

- a) Perceptions of the learning environment;
- b) Use of ICT; and
- c) Outcomes in terms of:
 - i. Self-efficacy;
 - ii. Enjoyment of their class; and
 - iii. Enjoyment of using ICT.

Research Objective 2

To examine the actual–preferred differences reported by primary school students in terms of their:

- a) Perceptions of the learning environment; and
- b) Use of ICT.

Research Objective 3

To examine the relationships between primary school students' perceptions of the learning environment and their self-reports of:

- a) Self-efficacy;
- b) Enjoyment of their class; and
- c) Enjoyment of using ICT.

Research Objective 4

To examine the relationships between primary school students' perceptions of their use of ICT and their self-reports of:

- a) Self-efficacy;
- b) Enjoyment of their class; and
- c) Enjoyment of using ICT.

Research Objective 5

To examine whether learning environment perceptions and outcomes (in terms of self-efficacy and enjoyment) differ for primary school students of different genders.

Research Objective 6

To examine whether learning environment perceptions and outcomes (in terms of self-efficacy and enjoyment) differ for primary school students who are at risk compared to those who are not at risk.

3.3 Use of Perceptual Measures: Rationale

The purpose of this research was to form generalisations from a sample to a population so that inferences could be made about primary school students' perceptions of their learning environment and use of ICT as well as the impact that these factors have on student outcomes (specifically, self-efficacy, enjoyment of class, and enjoyment of ICT). As such, the research was deductive in nature (Jha, 2008). Further, given the statistical and numerical descriptions of student perceptions generated by the questionnaires, the research was quantitative in design (Creswell, 2014; Fowler, 2009).

Central to learning environment research is a focus on students and a recognition of their role as the core participants in their learning (Dumont, et al., 2010; Fraser, 2012c). Hence, student perceptual data is widely used to assess learning environments (Aldridge, Afari, et al., 2012, Aldridge, Fraser, et al., 2012; Aldridge & Galos, 2017; Fraser, 2012c). According to Fraser (2012a), the subjective approach involved in the use of perceptual measures relates to Murray's (1938) beta press model (described in the previous chapter). Murray's (1938) approach is widely supported in psychological literature as it recognises, first, that humans are social in nature (with classrooms involving social interaction among their inhabitants), and, second, that the environment can impact and influence social interaction and behaviour (Moos, 1973).

The use of student perceptions to examine learning environments involves a philosophical shift from a focus on curriculum and test results to a focus on the student (Fraser, 1989). As explained by Dumont, et al. (2010, p. 15), "the emotional and cognitive dimensions of learning are inextricably entwined. It is therefore important

to understand not just learners' cognitive development but their motivations and emotional characteristics as well."

Past research has provided compelling evidence to suggest that student perceptions and student emotions are important determinants of learning (Schneider & Stern, 2010). For example, research by Schunk (1992) suggests that student perceptions can mediate the relationships between the classroom and school environments and student outcomes. Further, researchers such as Earl (2003), Fraser (2001), Fullan (2011), and Timperley (2011) support the use of student perceptions as an important form of data given the extensive amount of time that students spend in classroom settings. A range of research exists that suggests that students' perceptions of their learning environment can result in considerable variance in learning outcomes, with this variance often being greater than that attributed to individual student characteristics such as general ability (Chipangura & Aldridge, 2017; Dorman, 2003; Dorman & Fraser, 2009; Eccles & Wigfield, 2002; Fraser, 2012c; Soebari & Aldridge, 2015, 2016; Velayutham & Aldridge, 2013). In other words, students are likely to learn better when they have positive perceptions of their classroom environment. For this reason, learning environment research has utilised the assessment of students' and teachers' perceptions as the dominant source of data for nearly five decades, and much research now exists in this field (Aldridge, Afari, et al., 2012, Aldridge & Fraser, 2008; Aldridge, Fraser, et al., 2012; Aldridge, Fraser, & Sebela, 2004; Bell & Aldridge, 2014; Fraser & Fisher, 1983a; Sinclair & Fraser, 2002; Yarrow, 1997).

The use of perceptual measures as opposed to classroom observations is justified on the following grounds (Fraser, 1994, 2012a):

- The paper-and-pencil questionnaires used in perceptual methods are more parsimonious than classroom observations, which involve employing and training outside observers;
- The data gathered from perceptual methods are based on the experiences of students over several lessons rather than those of an observer who might be present for only a limited number of lessons;
- Perceptual methods identify the opinions of numerous students in a classroom setting as opposed to those of a single observer;

- Student perceptions are determinants of student behaviour and, as a result, can be more important data sources than observed behaviours; and
- Student perceptions have typically been found to account for substantially more variance in student achievement outcomes than observed behaviours.

The present study utilised student perception measures (through the use of surveys) to provide an economical and time effective method of gathering student data. These measures were used to assess students' experiences of their learning environment, use of ICT within the classroom and the impact that these factors have on student outcomes (specifically, self-efficacy, enjoyment of class, and enjoyment of ICT). The remaining sections of this chapter provide details related to the sample selection (Section 3.4); development of the instruments used for data collection (Section 3.5); data analysis (Section 3.6); and ethical considerations (Section 3.7).

3.4 Sample

This section details the selection of the research sample, including the:

- Selection of schools (Section 3.4.1);
- Selection of classes and teachers (Section 3.4.2);
- Selection of students (Section 3.4.3); and
- Identification of at-risk students (Section 3.4.4).

3.4.1 Selection of Schools

Convenience sampling, based on the researcher's contacts with Catholic schools in Western Australia, was used to select schools for the present study. Convenience sampling involves the selection of the most accessible participants to the researcher (Marshall, 1996). Within the selection of schools known to the researcher, purposive sampling (based on the researcher's knowledge of the individual schools) was utilised to select the schools from which the classes, involved in the research, were drawn. Purposive sampling is the process of selecting participants based on the qualities that they possess and is reliant upon the researcher's judgement (Fink, 2003). In this study,

the purposive sampling technique was used to increase the generalisation of the findings by ensuring that a wide range of schools was included.

The criteria used for the selection of schools were that:

- The sample of schools should include a range of Index of Community Socio-Educational Advantage⁶ (ICSEA) values, including schools above and below the average ICSEA score;
- The sample should include schools located in both metropolitan and regional areas; and
- The sample should include schools with a range of enrolment sizes.

All of the schools that were included in the sample were Catholic. This was a consequence of the convenience sampling used due to the researcher working within the Catholic Education of Western Australia system and thus having a knowledge of the school contexts and access to school principals within this system. The principals from 12 coeducational Catholic schools were approached regarding participation in the project, and expressions of interest were sought. The acceptance rate of principals approached was 100%.

The ICSEA values for the selected schools ranged from below average (the lowest value being 977 for a school in regional Western Australia) to above average (the highest value being 1123 for a school from the Perth metropolitan area). This range of ICSEA scores ensured that the participants would include a range of socio-economic backgrounds. The selected schools included one regional school (115 kilometres from the city of Perth), three outer metropolitan schools (ranging in distance of 35 to 50 kilometres from the city of Perth), and eight metropolitan schools. This geographic distribution was generally representative of Catholic schools in these regions at the time that this research took place.

⁶ The Index of Community Socio-Educational Advantage (ICSEA) was created by the Australian Curriculum, Assessment and Reporting Authority (ACARA) to represent numerically the influence that students' family backgrounds (parents' occupation and school education) and other factors such as geographical location have on students' educational outcomes. ICSEA scores allow meaningful comparisons to be made between schools. The average ICSEA score is 1000.

The 12 schools were also selected based on their enrolment numbers to provide a sample of schools of different sizes. Specifically, the selection was based on the number of classes in each year level. The sample for the present study included six schools with one class at each year level, two schools with two classes at each year level, three schools with three classes at each year level. One school included in the sample was a kindergarten to year 12 college. The total school enrolment numbers ranged from 140 to 1800 students. Table 3.1 provides a summary of the school ICSEA values, locations, and sizes.

Table 3.1. Range of schools involved in the study

| School | ICSEA value | Enrolment number | Location |
|-----------|-------------|------------------|--------------------|
| School 1 | 1092 | 230 | Metropolitan |
| School 2 | 1066 | 240 | Metropolitan |
| School 3 | 1025 | 690 | Metropolitan |
| School 4 | 1037 | 220 | Outer metropolitan |
| School 5 | 1024 | 730 | Metropolitan |
| School 6 | 1060 | 210 | Metropolitan |
| School 7 | 1047 | 520 | Metropolitan |
| School 8 | 1018 | 670 | Metropolitan |
| School 9 | 983 | 380 | Outer metropolitan |
| School 10 | 1123 | 1800 | Metropolitan |
| School 11 | 1025 | 180 | Outer metropolitan |
| School 12 | 977 | 140 | Regional |

3.4.2 Selection of Classes and Teachers

Once the principal of each of the twelve schools had provided permission for the study to take place (as described in Section 3.4.1), information regarding the study was sent to all classroom teachers within the schools who worked in years 4, 5, or 6 (as the three surveys were designed for students in these year levels), and expressions of interest were sought. In total, 60 teachers were invited to participate in the study, and, of these, 32 teachers expressed an interest to be involved.

Given that research objective 6 sought to compare the perceptions of academically at-risk students with those of students who were not at risk (see Section 3.2), each of the classes that was selected was required to include at least three at-risk students (the identification of at-risk students is detailed further in Section 3.4.4). Of the 32 expressions of interest, all of the teachers who had a minimum of three at-risk students in their class were included in the sample. Despite teachers' expressions of interest, one year 4 and one year 5 class were excluded from the study as they did not meet this criterion. In total, 30 teachers and 31 classes participated in the study (with one teacher administering the questionnaires to two classes). The sample included 11 year 4 classes, 11 year 5 classes, and nine year 6 classes.

3.4.3 Selection of Students

Given that research objective 6 sought to compare the perceptions of students who were academically at risk and those who were not at risk, it was important to ensure not only that the sample was generally representative of the population but also that there was a representative sample of at-risk students. The NAPLAN minimum standards provide an indication of the level of learning that students should typically demonstrate by a particular point in their schooling (ACARA, n.d.). Students who fall below the minimum standard in a particular area, have not achieved the expected learning outcomes for their year level. Hence, they are at risk of being unable to make appropriate progress without some form of intervention. A more detailed explanation of the national minimum standard and students considered to be at risk are provided in Section 3.4.4.

The criteria for the selection of students from each class (including but not limited to academically at-risk students) were that the students:

- Did not have a diagnosed learning disability (for ethical reasons outlined in Section 3.7);
- Had provided verbal consent to participate in the study; and
- Had received written consent to participate in the study from a parent or legal guardian.

All of the students who fulfilled this criterion and were present on the day of administration were included in the sample. Administration of each survey to a total of 609 students was conducted on two separate days. Given that some students were not present on either one of the administration days, a matched sample was used consisting of only those students who were present on both days. 609 students responded on the first day and, due to absences, 583 students responded on the second day, providing a reduced sample of 574 students.

This sampling method provided a sample of 574 students, 283 of whom were male and 291 of whom were female. A total of 170 of the students were identified as at risk (according to the identification protocols detailed in Section 3.4.4), and 404 of the students were not at risk. The sample included 158 students in 11 year 4 classes, 252 students in 11 year 5 classes, and 164 students in nine year 6 classes. Table 3.2 provides a breakdown of the 574 students included in the sample.

Table 3.2. Breakdown of students in the sample according to gender and ability

| Gender / Ability | Year 4 (11 classes) | Year 5 (11 classes) | Year 6 (9 classes) | Total (31 classes) |
|------------------------|------------------------|------------------------|-----------------------|-----------------------|
| Male | 83 | 121 | 79 | 283 |
| Female | 75 | 131 | 85 | 291 |
| At-risk | 31 | 68 | 71 | 170 |
| Above minimum standard | 127 | 184 | 93 | 404 |
| Total | 158 | 252 | 164 | 574 |

N = 574

3.4.4 Identification of At-Risk Students

For the purposes of this study, the Australian National Assessment Program Literacy and Numeracy (NAPLAN) results were used to determine whether a student was considered to be academically at risk. The Australian Curriculum, Assessment and Reporting Authority (ACARA) is an independent statutory authority that manages the implementation of the national curriculum, nationwide student assessment, and reporting of educational outcomes at a school level. ACARA has responsibility for the

development, implementation and reporting of the NAPLAN assessment. The NAPLAN assessments are administered annually to all Australian students in years 3, 5, 7, and 9 and test skills that are considered to be essential to progress through school and life (ACARA, n.d.). Students are assessed in reading, writing, spelling, grammar and punctuation, and numeracy. Reading, writing, and numeracy results were used to determine whether students were at or below the minimum standard and therefore academically at-risk for the purposes of the present study, as these were determined by the researcher to be the three core assessment scales given that the other two scales, spelling and grammar and punctuation, are skills within the writing process.

To make judgements about students' achievement and expected performance, ACARA has set a minimum national standard for each assessment in the form of a specific point of reference or benchmark on the assessment scale (Klenowski & Wyatt-Smith, 2010). Each of the NAPLAN assessment scales (reading, writing, spelling, grammar and punctuation, and numeracy) is divided into ten hypothetical bands. These bands cover the entire range of student achievement for that assessment with band 1 representing the highest group of scores and band 10 representing the lowest. Each band contains a range of scores and the national minimum standard is represented by a particular band at each year level. In the NAPLAN results, each student is identified as being above, at, or below the minimum standard for each NAPLAN area. The NAPLAN minimum standards provide an indication of the level of learning that students should typically exhibit by a given point in their schooling (ACARA, n.d.). Students who fall below the minimum standard in a particular area, have not achieved the expected learning outcomes for their year level. Hence, they are at risk of being unable to make appropriate progress without some form of intervention (Brinkman et al, 2013) and are at an educational disadvantage (Louden, Chan, Elkins, & Greaves, 2000). For the purposes of this study, academically at-risk students were defined as those students who performed either *at* or *below* the minimum standard in their year 3 or year 5 reading, writing, and/or numeracy NAPLAN tests.

The criterion of identifying students who scored *below* the NAPLAN minimum standard as being at risk was selected for the present study as this criterion indicates that these students have not achieved the expected outcomes for their year level. Students who scored *at* the standard were also determined to be at risk for two reasons.

First, the standard is a minimum requirement, that is, the lowest point of acceptable attainment. Second, it is difficult to ensure that students who may be at this minimum standard will not slip below the standard without additional support, particularly students who score towards the bottom of the minimum standard band or range of scores.

For ethical reasons (as outlined in Section 3.7), students with diagnosed learning disabilities were not included in the sample for the present study. Although such students were likely to meet the criteria of performing at or below the minimum NAPLAN standard, they were excluded from the sample for three reasons. First, a student’s learning disability could potentially mean that they were unable to adequately read and comprehend the survey questions. Second, these students may have experienced distress due to difficulties in comprehending and completing the questionnaire. Finally, students with significant learning disabilities are often granted exemption from completing the NAPLAN assessments, resulting in a lack of assessment data; consequently, it would not have been possible to determine whether or not such students met the sample criterion for this study.

As described in Section 3.4.3, from the sample of 574 students, 170 students were identified as being academically at risk and 404 as being not at risk. Of the 170 at-risk students, 94 were male and 76 were female. Thirty-one of the at-risk students were in year 4 (14 male and 17 female), 68 in year 5 (42 male and 26 female), and 71 in year 6 (38 male and 33 female). Table 3.3 provides a breakdown of the at-risk students included in the sample based on gender and year level.

Table 3.3. Breakdown of at-risk students in the study sample based on gender and year level

| | Year 4 | Year 5 | Year 6 | Total |
|----------------|--------|--------|--------|-------|
| At-Risk Male | 14 | 42 | 38 | 94 |
| At-Risk Female | 17 | 26 | 33 | 76 |
| Total | 31 | 68 | 71 | 170 |

The data from the sample of 178 at-risk students, that is, students who scored at or below the national minimum standard in their reading, writing or numeracy NAPLAN results, were utilised in the present study to assess whether learning environment perceptions and outcomes (in terms of self-efficacy, enjoyment of class, and enjoyment of ICT) differ for at-risk students compared to those of students who were not considered to be at-risk (and therefore addressing research objective 6).

3.5 Instruments used for Data Collection

Data collection for the present study involved the administration of three instruments online: one to assess students' perceptions of the learning environment; one to assess students' use of ICT within the classroom; and one to assess the student outcomes of self-efficacy, enjoyment of class, and enjoyment of using ICT. Given that valid and reliable surveys on these topics were not available for use in the primary school, it was necessary to develop new surveys for each purpose. A detailed description of the instruments developed for use in the present study and the theoretical basis for the inclusion of the scales is provided in Chapter 4; therefore, this section provides only a brief overview of the processes used to develop the instruments and collect data. This section, first, outlines the steps taken to develop the three new surveys (Section 3.5.1); second, describes each of the surveys (Section 3.5.2); and, third, outlines the data collection process (Section 3.5.3).

3.5.1 Development of the Instruments

As established in Chapter 2, the dearth of available instruments for use at the primary school level made it necessary to develop new surveys for use in the present study. Therefore, an important contribution of this study involved developing and validating three surveys to assess primary school students' (a) learning environment perceptions; (b) use of ICT; and (c) outcomes (in terms of self-efficacy, enjoyment of class, and enjoyment of using ICT; research objective 1). This section describes the multi-stage approach, involving six steps, that was used to develop all of the three surveys.

3.5.1.1 Step 1: Literature Review

In the first step, a review of literature was carried out to identify historical and theoretical insights in the fields of learning environment research and the use of ICT within the classroom (this review is summarised in Chapter 2). Key constructs relevant to the primary school classroom were examined and identified, namely, cohesiveness, support, equity, clarity, responsibility for learning, involvement, task orientation, relevance, and collaboration. Various precedents exist for modifying and adapting scales from existing instruments (Aldridge et al., 2009; Bell & Aldridge, 2014; Fraser, 2012c; Velayutham, et al., 2011). Hence, several previously validated surveys were examined. The COLES, designed by Aldridge, Fraser, et al. (2012), was identified as an existing survey that was valid and reliable and that assessed several of the key constructs identified as being relevant to the primary school classroom.

During the review, literature related to the integration of technology into the classroom environment was conducted. During this process, the ICT general capability from the Australian Curriculum (ACARA, n.d.) was examined to determine constructs that may be relevant to the use of ICT within the primary school classroom. To ensure that the development of a new survey to assess ICT use in the classroom was relevant for teachers and linked to the Australian Curriculum, the organising elements within the ICT general capability were identified as key constructs for use in the present study. These elements were investigating with ICT, creating with ICT, communicating with ICT, applying social and ethical protocols and practices, changing trends, and managing and operating ICT effectively (ACARA, n.d.). A review of existing instruments to assess ICT use in the classroom was conducted; however, no surveys were located that were suitable for use in the present study as they did not assess the identified constructs.

Finally, student outcomes likely to be affected by the identified learning environment and use of ICT constructs were also reviewed. The constructs of student self-efficacy, enjoyment of class, and enjoyment of using ICT were considered to be relevant to the purposes of the present study. A review of existing instruments related to the measurement of student outcomes was conducted. The Attitudes and Self-Belief

Survey (ASBS), developed by Bell and Aldridge (2014), was identified as a valid and reliable tool for assessing students' attitudes towards learning.

3.5.1.2 Step 2: Selecting and Developing Relevant Scales

The second step of developing the instruments involved selecting relevant scales from existing surveys and modifying these scales to more fully address the identified constructs in a manner appropriate for the primary school level. For each of the instruments, the scales were examined closely to identify their relevance to students at the primary school level.

In summary, the COLES (Aldridge, Fraser, et al., 2012) was identified through the literature review as a valid and reliable instrument for assessing students' learning environment perceptions in secondary schools, and the ASBS (Bell & Aldridge, 2014) was identified as a valid and reliable tool for assessing the student outcomes of self-efficacy and enjoyment at a secondary level. Therefore, several scales from the COLES and ASBS were scrutinised and considered to match the constructs identified as important for the present study and to be suitable for adaptation for use in the primary school classroom. A description and justification for the inclusion of each scale is provided in Section 4.2.1 (for the learning environment scales); Section 4.3.1 (for the ICT use scales); and Section 4.4.1 (for the student outcomes scales).

3.5.1.3 Step 3: Modifying and Developing Items

In the third step of instrument development, the wording of the individual scale items in the selected COLES and ASBS scales was reviewed. Individual items were scrutinised to ensure their suitability, and, where necessary, the wording of items was simplified to ensure that they were appropriate for the reading level of primary-aged students. Items in the original surveys that were not pertinent or were considered to be too difficult for primary aged students to understand were omitted and replaced with new items.

New scales and items were developed at this stage to assess students' use of ICT, based on the organising elements of the ICT general capability of the Australian

Curriculum (as outlined in Sections 2.3.1 and 4.3.1.1). Scales and items were designed to assess the extent to which teachers were integrating each element of the ICT general capability into the primary school classroom.

Further results related to the development of scales are provided in Section 4.2.1 (for the learning environment scales); Section 4.3.1 (for the ICT use scales); and Section 4.4.1 (for the student outcomes scales).

3.5.1.4 Step 4: Deciding the Response Format

In this step, consideration was given to the response format that was to be used for the survey items. To ensure consistency throughout the study, the same response format was utilised for all three instruments. It was important to consider the ability of primary-level students to effectively use the response format and to distinguish between the different response options; therefore, a simplified five-point frequency response format was utilised. This response format is described further in Section 4.2.

3.5.1.5 Step 5: Expert Review Panel

This step involved a review of the items, scales, and response format by an expert review panel. The panel was made up of eight experienced primary educators, including two experienced teachers (who were currently teaching in classrooms) and six primary education consultants (employed by the Catholic Education Western Australia, CEWA). Consultants at CEWA are identified as experts in their field and are employed to assist teachers to implement effective instruction in their field of expertise. Each consultant was highly experienced and involved in providing training and advice to teachers in the areas of literacy, mathematics, early childhood education, and digital learning.

The role of the panel members was to give advice on content validity, ensuring that the survey items were relevant to and adequately covered the construct that each scale was intended to assess. The panel members were also asked to examine whether the language used within the instruments was suitable for primary school-aged students.

Feedback was gathered verbally at meetings with the panel members individually or in pairs.

The results of the feedback from the expert panel are outlined in Section 4.2.1.2 (for the learning environment scales), Section 4.3.1.1 (for the ICT use scales) and Section 4.4.1.2 (for the student outcomes scales).

3.5.1.6 Step 6: Pilot Testing the Surveys

Once the scales, items, and response format had been modified based on the feedback from the expert panel, the newly developed instruments were pilot tested. The pilot test involved one class of 30 year 4 students who responded to the surveys online. Year 4 students were selected for the pilot test because they were the youngest students likely to be involved in responding to the questionnaires in this study. As such, it was anticipated that they were likely to have the lowest reading level of the respondents. The year 4 class involved in the pilot provided a cross-section of students, including at-risk students. The purpose of the pilot test was threefold:

- To examine any technical issues involved in responding to the surveys online;
- To determine the face validity of the individual items; and
- To assess the usability of the response format.

Each of these purposes is described below.

First, the pilot test was used to examine technical issues related to the administration of the surveys. In particular, the intention was to determine:

- The ease of setting up the surveys for the classroom teacher;
- Whether the students could effectively use the login function;
- The ease of moving through each page of the online surveys;
- Whether the response buttons were easy to use;
- Whether the font size was easy to read;
- Whether the system ensured that students did not skip survey questions; and

- The length of time taken to complete the surveys.

The pilot study also examined the face validity of the individual items and the usability of the response format. To this end, interviews with six students (purposefully selected to ensure that a range of abilities was represented) were used. The classroom teacher assisted with the selection of the students; two students had low reading abilities, two had average reading abilities, and two had high reading abilities. To examine whether these students had interpreted the items in the ways that were intended by the researcher (face validity) and to evaluate the usability of the response format, the students were asked to provide explanations and examples for their responses to different items. Based on these interviews, minor adjustments were made to individual items before the large-scale administration. These adjustments are outlined in Section 4.2.1.2 (for the learning environment scales); Section 4.3.1.2 (for the ICT use scales); and Section 4.4.1.2 (for the student outcomes scales).

Once the development process of the three new surveys was completed, the surveys were administered in 31 classrooms in order to collect data to address the remaining five research objectives of the present study. A short description of each survey is provided in the following section (Section 3.5.2) and Section 3.5.3 outlines the data collection process.

3.5.2 *Description of the Instruments*

This section provides a brief overview of the three surveys that were developed. A detailed description of the instruments used in the present study and the theoretical basis for the inclusion of each scale is provided in Chapter 4.

3.5.2.1 Assessing Students' Perceptions of the Learning Environment

To assess students' perceptions of the learning environment, the Classroom Climate Questionnaire–Primary (CCQ-P) was developed. The CCQ-P was comprised of nine scales, namely:

- Student Cohesiveness (the extent to which students know, help, and are supportive of one another);
- Teacher Support (the extent to which the teacher helps, befriends, and is interested in students);
- Equity (the extent to which students feel that they are treated fairly and equally by the teacher);
- Task Clarity (the extent to which instructions for tasks are explicit and clear so that students know what they need to do);
- Responsibility for Learning (the extent to which teachers give students responsibility and encourage them to be independent in their learning);
- Involvement (the extent to which students participate in discussions, ask questions, and share ideas);
- Task Orientation (the extent to which it is important to complete planned activities and to stay on task);
- Personal Relevance (the extent to which class activities are made relevant to students' everyday out-of-school experiences); and
- Collaboration (the extent to which students cooperate and work together on learning tasks).

Each scale was comprised of five items, providing 45 items in total. A more detailed description of the CCQ-P—including the layout, response format, and theoretical basis for the inclusion of individual scales—is provided in Section 4.2.1. A copy of the CCQ-P used in the present study can be found in Appendix 3.

3.5.2.2 Assessing Students' Perceptions of ICT Usage

To assess students' use of ICT in the classroom environment, the ICT Usage Survey was developed. This survey was developed using the ICT general capability within the Australian Curriculum (ACARA, n.d.). The items and scales in the new survey were aimed at assessing the degree to which teachers incorporated the six organising elements of this general capability into their classroom instruction. That is, the survey was intended to assess the type and frequency of technology usage that students are exposed to within the learning environment.

The ICT Usage Survey was comprised of six scales, namely:

- Investigating with ICT (the extent to which students define and plan information searches; locate, generate, and access data and information; and select and evaluate data and information);
- Creating with ICT (the extent to which students generate ideas, plan, and process and generate solutions to challenges and learning tasks);
- Communicating with ICT (the extent to which students collaborate, share, exchange, and understand computer-mediated communications);
- Applying Social and Ethical Protocols and Practices (the extent to which students recognise intellectual property, apply digital information security practices, apply personal security protocols, and identify the impacts of ICT in society);
- Changing Trends (the extent to which students perceive that ICT has altered the way teaching and learning occurs in this class); and
- Managing and Operating ICT Effectively (the extent to which students select and use hardware and software effectively, understand ICT systems, and manage digital data).

In total, the ICT Usage Survey included 36 items with the following numbers of items in each scale: Investigating with ICT—six items; Creating with ICT—seven items; Communicating with ICT—eight items; Applying Social and Ethical Protocols and Practices—five items; Changing Trends—four items; and Managing and Operating ICT Effectively—six items.

A more detailed description of the development of the ICT Usage Survey—including the layout, response format, and theoretical basis for the inclusion of individual scales—is provided in Section 4.3.1. A copy of the ICT Usage Survey used in the present study can be found in Appendix 4.

3.5.2.3 *Assessing Students' Self-Reports of Self-Efficacy and Enjoyment*

To assess students' self-beliefs and their enjoyment of class and ICT, the Self-Efficacy and Enjoyment Questionnaire (SEEQ) was developed. The SEEQ is comprised of three scales, namely:

- Self-Efficacy (the degree to which students believe in their ability to successfully perform learning tasks);
- Enjoyment of Class (the degree to which students find their class to be enjoyable and fun); and
- Enjoyment of ICT (the degree to which students enjoy using ICT).

Each scale was comprised of five items, providing 15 items in total. A more detailed description of the development of the SEEQ—including the layout, response format, and theoretical basis for the inclusion of individual scales—is provided in Section 4.4.1. A copy of the SEEQ used in the present study can be found in Appendix 5.

3.5.3 *Collection of Data*

Following the development of the three instruments, the surveys were administered to the sample. The Self-Efficacy and Enjoyment of Class scales from the SEEQ were administered with the CCQ-P to a sample of 609 students in 31 classes within 12 schools (as described in Section 3.4). The Enjoyment of ICT scale from the SEEQ was administered with the ICT Usage survey to 583 students within 31 classes. Given that the two administrations of surveys occurred on different days (to avoid student fatigue) the difference in sample sizes is a result of differing student attendance numbers on the second day of survey administration. This section outlines the process that was used to collect the data.

Prior to the administration of the surveys, the researcher met with each teacher either individually or in small groups to provide information about the aims of the study, the purpose of the instruments, the feedback that would be provided to the teachers, and the instructions for administering the surveys. During these meetings, written consent was obtained from each teacher, and parent consent forms for student participation

were provided for distribution. At this stage, the researcher assisted the teachers to determine whether there were any students in their classes that should not, ethically, be included in the sample (as described in Section 3.7).

To provide consistency in the data collection and to ensure that students understood the purpose of the activity and how to complete the surveys, the teachers were provided with written instructions. Scripted information was provided to assist teachers, as follows:

1. This is not a test. I am interested in your thoughts about what happens in the classroom. You do not have to participate if you don't want to, and you are free to stop at any time if you no longer want to participate. You will not be in trouble.
2. The survey is confidential, and I will not be able to see your answers. I will only be able to see an overall class result (average).
3. It is important for you to be honest. I value your ideas and will use this information to decide if some changes could be made to improve the classroom.
4. The survey is made up of a number of statements; you need to read each statement carefully and then indicate how often you think they happen. For some statements, there are two columns. The first column, ACTUAL, asks you about how often things happen in the classroom. The second column, PREFERRED, asks you to indicate how often you would like them to happen. If you are happy with what happens in the classroom for a particular statement, you would put the same response for actual and preferred.

Given the age of the respondents, the teachers were advised that, where necessary, they could read the items aloud for students who experienced difficulty reading the surveys.

Following the meetings with teachers and the collection of parent consent forms, student logins were generated and provided to each class teacher. Teachers administered the surveys to those students in their class who had parental consent and

met the eligibility criterion. To reduce student fatigue, administration of the surveys occurred in the morning and the three different survey instruments were not all administered on the same day. Following the survey administration, a feedback package presenting the aggregated responses of students in a class were provided to each teacher.

Upon conclusion of the development and administration of the three new surveys, the data collected was analysed, first, to provide evidence to support the validity and reliability of the instruments for use in further research (addressing research objective 1). Second, the data was examined to address the remaining five research objectives of the present study. The data analyses conducted in this research is summarised briefly in Section 3.6 and explained in more detail in Chapters 4 and 5.

3.6 Data Analysis

For the purposes of the present study, analyses were conducted on the data collected first, from the administration of the CCQ-P, SEEQ and ICT Usage Survey. Given that the administration of the surveys were administered over two days, to avoid fatigue, only data from students who were present on both days was included. This provided a sample of 574 students.

The data analyses, carried out to address the objectives of the present study, can be divided into two parts. The first part involved the validation of the three newly-developed surveys, the results of which are reported in Chapter 4. The second part involved the analysis of data to answer research objectives 2 to 6, the results for which are reported in Chapter 5. Below, Sections 3.6.1 to 3.6.4 outline the data analysis processes used to address each research objective.

3.6.1 *Research Objective 1: Validation of Surveys*

It is widely accepted that the need exists for a thorough validation model of instruments used for research purposes (Leye, Himmelspach, & Uhrmacher, 2009). Verification and validation involve ensuring that a survey is constructed correctly and that it behaves with satisfactory accuracy, consistent with its objectives (Balci, 2003).

Validation of the three surveys developed for the purposes of this study was important to provide confidence in the findings of the remaining research objectives. The validation process was guided by Trochim and Donnelly's (2008) construct validity framework (see Figure 3.1). Construct validity ensures that the internal constructs of any model accurately reflect the purpose and intention of the survey; that is, a causal relationship exists between the construct and what is being measured (Leye et al, 2009; Teglassi, Nebbergall, & Newman, 2012).

According to Trochim and Donnelly's (2008) framework, a construct must meet the requisites of both translation and criterion validity. The following sections describe translation validity (Section 3.6.1.1) and criterion validity (Section 3.6.1.2) in relation to Trochim and Donnelly's (2008) construct validity framework. Based on this framework, the present study used translation validity and criterion validity to ensure that the three surveys developed were valid measurement tools.

3.6.1.1 Translation Validity

According to Trochim and Donnelly's (2008) construct validity framework, translation validity ensures that the operationalisation of the construct (in this case, the items used in each scale of the three surveys), accurately represents its theoretical foundation and can be comprehended by the respondents. Translation validity includes two elements: content validity and face validity. Content validity "focuses on whether the construct is theoretically sound and provides an all-encompassing representation of the construct" (Velayutham et al, 2011, p. 7). In the context of this study, content validity ensured that the scales of the surveys were based on research or theoretical grounds and were appropriate for the purpose of the survey, as recommended by Li and Sireci (2013). Face validity, on the other hand, was examined to ensure that the items were interpreted by the participants in ways that were intended by the researcher.

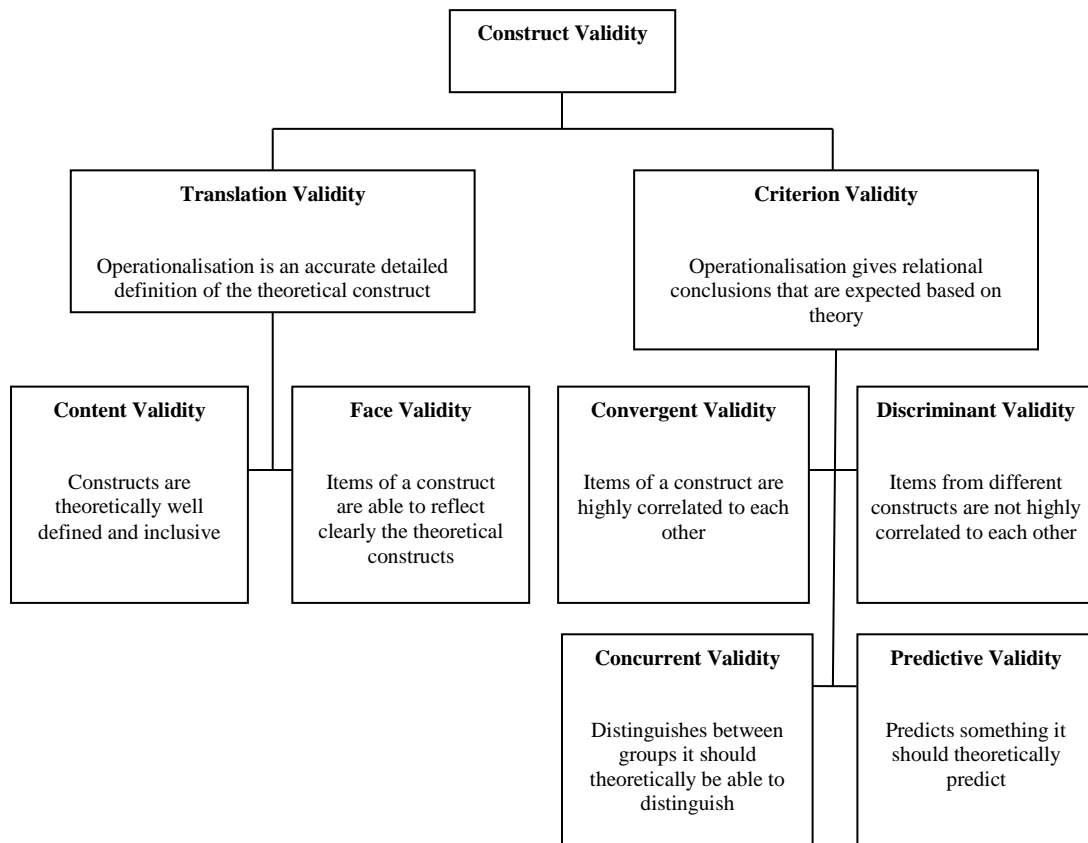


Figure 3.1 Construct validity framework (Trochim & Donnelly, 2008)⁷

3.6.1.2 Criterion Validity

The second part of Trochim and Donnelly’s (2008) framework focuses on criterion validity. Criterion validity examines the relationships between items within a construct and focuses on whether the operationalisation of the construct provides conclusions about these relationships that are expected, based on theory. According to Trochim and Donnelly (2008), there are four elements of criterion validity. The items of a construct should correlate highly with each other (convergent validity), and the correlations between items of different constructs should be relatively low (discriminant validity). Constructs should also be able to distinguish between groups that the constructs are theoretically intended to distinguish (concurrent validity) as

⁷ Reproduced by permission; see Appendix 6.

well as to predict things that they should, theoretically, be able to predict (predictive validity).

Convergent validity assesses whether the construct items correlate highly with each other. The factor structure and internal consistency reliability were examined to confirm the convergent validity of each survey. Principal axis factoring with oblique rotation was used to check the structure of each survey. As recommended by Pallant (2011), oblique rotation was utilised due to the overlapping nature of the learning environment dimensions. As recommended by Field (2009) and Thompson (2004), two criteria were used for retaining any item. First, the item must have a factor loading of at least .40 on its own scale, and, second, it must have a loading of less than .40 on all of the other scales. Cronbach's alpha coefficient was used as an index of internal consistency reliability to assess whether the items within the same scale assessed the same construct. Two units of analysis were used to assess internal consistency reliability, namely, the individual and class means.

To confirm discriminant validity, the items of different constructs should not correlate highly with each other. An intercorrelation matrix generated during oblique rotation, as recommended by Brown (2014) and Field (2009), was used in the present study to provide evidence to support the discriminant validity of the survey scales.

To support concurrent validity, a given construct should be able to distinguish between groups that it is theoretically intended to distinguish (Trochim & Donnelly, 2008). In theory, students within the same classroom should have somewhat comparable perceptions of their learning environment whereas the perceptions of students from different classes should differ (Aldridge & Galos, 2017). Therefore, to examine the concurrent validity of each survey, an ANOVA was calculated for each scale, with class membership as the independent variable.

Finally, predictive validity focuses on the extent to which a given construct can predict something which it should, theoretically, be able to predict (Trochim & Donnelly, 2008). To provide evidence to support the predictive validity of each instrument in the present study, simple correlation was used.

3.6.2 *Research Objective 2 – Differences between Actual and Preferred Learning Environment Perceptions*

The second research objective sought to examine whether differences existed between primary school students' actual and preferred perceptions of their learning environment and the extent of ICT usage within the classroom. As a first step, the average item mean and average item standard deviations were calculated separately for the actual and preferred responses for each scale. To examine whether these actual—preferred differences were statistically significant, Wilks' Lambda (Wilks, 1935), was examined; the results of this examination led to the interpretation of the MANOVA for each scale. The scales of the CCQ-P and the ICT Usage Survey were used as the independent variables and students' actual and preferred responses were used as the dependent variables. Finally, to examine the magnitude of the differences between students' responses to the actual and preferred versions of each scale, the effect sizes were calculated (as recommended by Thompson, 2001).

3.6.3 *Research Objectives 3 and 4 – Associations between the Learning Environment, Use of ICT, and Student Outcomes*

The third and fourth research objectives sought to examine whether relationships existed between the affective outcomes of self-efficacy, enjoyment of class, and enjoyment of using ICT and (a) students' perceptions of the learning environment (research objective 3) and (b) their perceived use of ICT within the classroom environment (research objective 4). Data analyses were conducted on the sample of 574 students (described in Section 3.4.3) using the actual responses. Simple correlation analysis was used to examine the bivariate relationships between each of the three outcome scales (from the SEEQ) and the CCQ-P and ICT Usage Survey scales. Multiple regression analyses (R) were used to determine the joint influence of the set of SEEQ scales (as independent variables) and the individual CCQ-P and ICT Usage Survey scales (as dependent variables), using the class mean as the units of analysis. To identify which of the CCQ-P and ICT Usage Survey scales contributed uniquely and significantly to the explanation of the variance in students' self-efficacy and enjoyment (of class and use of ICT), standardised regression coefficients (β) were examined.

3.6.4 Research Objective 5 and 6 – Differences in Perceptions and Outcomes between Groups of Students

The fifth research objective sought to examine whether perceptions of the learning environment, ICT usage and outcomes (self-efficacy, enjoyment of class, and enjoyment of using ICT) differed for students of different gender. Similarly, the sixth research objective sought to examine whether perceptions of the learning environment, ICT usage and outcomes (self-efficacy, enjoyment of class, and enjoyment of using ICT) differed for academically at-risk and not-at-risk students.

Data analyses were conducted on the sample of 574 students using the actual responses. To examine whether differences existed between the perceptions of these groups of students, MANOVA was once again utilised. Separate MANOVA analyses were conducted for all three instruments (CCQ-P, ICT Usage Survey, and SEEQ) using the scales of each survey as the dependent variables and students' gender or at-risk status as the independent variable. Multivariate tests using Wilk's Lambda criterion were examined and, as a result, the univariate one-way ANOVA results were interpreted for each scale.

As there were different numbers of at risk / not-at-risk students within each class, the class mean was used as the unit of analysis. The one-way ANOVA provided an F value that compared the variability between groups to the variability within groups (Laerd Statistics, n.d.). The p value (or probability) of finding an F ratio as large as the one calculated by the one-way ANOVA was used to either reject or accept the null hypothesis, that is, that no differences exist in population means between the groups. Effect sizes were calculated to determine the magnitude of the differences between the scores of male and female students and between the scores of at-risk students compared with those students who were not at risk (as recommended by Thompson, 2001). Effect sizes were expressed in standard deviation units.

Given that at-risk and not-at-risk students reported different experiences of the learning environment, an analysis of covariance (ANCOVA) was used to examine these differences. The use of an ANCOVA allowed the preferred scores on the learning environment scales to be referenced against the actual scores and then

compared between the two groups of students (at risk and not at risk). This approach allowed for a comparison of the groups of students' preferred scores. In this analysis, responses to the preferred version were used as the dependent variables, the corresponding responses to the actual version were the covariates, and the student type (at risk or not at risk) was the independent variable.

The results of the data analyses described in this section are reported in Chapters 4 and 5. Chapter 4 outlines the results that provide support for the validity and reliability of the three new surveys (research objective 1) and Chapter 5 outlines the results of the data analyses to address the remaining five research objectives.

3.7 Ethical Considerations

The design of this study sought to follow the guidelines of ethical review of human research at all stages of the research. As a first step, ethics approval was obtained from Curtin University, prior to the commencement of research (See Appendix 7 for a copy of the ethics approval from Curtin University). This section outlines how ethical considerations were addressed to ensure that participants in the research were not put at risk of harm, were not disadvantaged, and were made aware that they could withdraw without prejudice.

3.7.1 Informed Consent and Voluntary Participation

Given that all of the schools involved in the research were within the Catholic education system, endorsement was obtained from Catholic Education Western Australia (CEWA) to conduct research within these schools (See Appendix 8 for the CEWA letter of consent). Consent for involvement in the study was also sought from the principal of each school, who then provided teachers with a summary of the purpose, procedures, and risks of the study and sought expressions of teachers' interest to participate. Subsequently, the recruitment of teacher participants was made on a voluntary basis. Both verbal and written information about the study and the administration of the student questionnaires was provided to all teacher participants. Teachers were provided with an information sheet which outlined the purpose, process, and benefits of the research. The role of the teacher was articulated in the

information sheet including the process of assisting the researcher to identify at-risk students and the criteria for this identification. The voluntary nature of the study was also highlighted (both verbally and in the information sheet), and confidentiality procedures were explained, including the assurance that information collected would not be made available to principals. The researcher met with each teacher in person prior to participation to verbally explain this information and to train the teachers in survey administration. A copy of the teacher information sheet and consent form can be found in Appendix 9.

An outline of the intended research outcomes and implications of participation was provided to the parents of the students to be involved, and written consent was obtained. The information sheet outlined the purpose, process, and benefits of the research. The information sheet also clearly articulated that participation was voluntary; that the right of any individual parent, student, or teacher to choose not to participate would be respected at all times; and that participants maintained the right to withdraw from the study at any time. Confidentiality procedures were outlined, and parents were assured that classroom teachers would not be able to identify individual student responses. A copy of the parent information sheet and consent form can be found in Appendix 10.

It was considered, given that the age of the participants ranged from nine to 12 years of age, the students would be capable of understanding the purpose of the study. Therefore, students were informed of the purpose of the research and the procedures involved (as recommended by Sargeant and Harcourt, 2012), both in written form through a student information sheet and verbally by the teacher. This communication occurred in class just prior to survey administration. The student information sheet used simplified language suitable for the age of the students and outlined the purpose and benefits of the research. The expectations of the students to participate in online questionnaires was described, and an estimate of the time involved was given. It was a priority that the students, in particular, understood that they were able to withdraw their initial consent at any time and did not feel pressured to participate, as recommended by Valentine (1999) and Fisher (2005). Therefore, the student information sheet clearly explained that answers were confidential and that the class teacher would not be able to see individual student responses. The information sheet

outlined that parent permission was required, that participation was voluntary, and that students could change their minds and ask to stop at any time. Teachers were asked to provide students with a printed copy of the student information sheet prior to administration of the questionnaires and to read and explain the information sheet verbally to students in order to obtain verbal consent from students. A copy of the student information sheet can be found in Appendix 11.

3.7.2 Confidentiality, Anonymity, and Potential Risks

Confidentiality and anonymity are essential ethical considerations when conducting research to ensure that participants are not harmed as a result of the study (Trochim & Donnelly, 2008). It is important, therefore, that all information that could potentially identify participants remains confidential and anonymous.

Principals were informed from the outset of the study that individual student and teacher results would not be available to them. The feedback provided to teachers did not identify individual student responses but rather provided average scores. All individual student, teacher, and school data were kept confidential through the use of student, class, and school codes. All identifying marks were removed prior to analysis and each school, class, teacher, and student name was replaced with codes that were available only to the researcher and her supervisor. This ensured that no individual student could be identified through the data.

The study was low risk in nature and it was considered by the researcher that the benefits of the research outweighed the potential risk. The questionnaires contained non-invasive and non-sensitive questions, and teachers were permitted to read the survey questions aloud to the students to reduce any distress that may have been caused by an inability to read the questions, particularly for the at-risk students. As discussed in Section 3.4.4, to avoid distress, any student with a diagnosed learning disability was not included in the research and was provided with an alternative activity by the teacher during the data collection period.

The expectations of teacher participants in terms of time and workload were kept to a minimum in order to avoid undue burden. Teachers were provided with feedback on

the data collected from their class in the form of reports and information about how to interpret their class data. At no time were teachers asked to share their data with another person. It was made clear to all participants through written information sheets that the data gathered would be used only for the purpose of the research and any subsequent publications.

The materials and participant data and information were saved in a password protected file and were only accessible to the researcher and researcher's supervisor. All hard copy information was stored in a locked drawer. Data obtained during the course of this study will be retained for a period of seven years and will then be destroyed.

3.8 Chapter Summary

This chapter outlined the research design and methods used to collect and analyse data for the present study. This process involved the development and administration of three online student surveys to gather feedback about the learning environment, use of ICT, and student self-efficacy and enjoyment (of both their class and their use of ICT).

The sample was purposively selected to ensure a representative range of schools, teachers, and classes between years 4 and 6. Twelve coeducational Catholic schools were involved in the study and included a range of enrolment sizes, ICSEA values, and geographic locations. The enrolment numbers of the schools ranged from 140 to 1800 students, and the schools comprised of one Western Australian regional school, three Perth outer metropolitan schools, and eight Perth metropolitan schools. The ICSEA values of the schools ranged from 977 (below the average ICSEA score of 1000) to 1123.

All year 4, 5 or 6 classroom teachers within the 12 participating schools were invited to participate in the study. Thirty (out of a possible 60) teachers expressed interest in being involved in the study and met the criteria for participation. Thirty-one classes were involved in the present study (with one teacher administering the questionnaires to two classes).

A total of 609 students responded to the surveys with a minimum of three at-risk students in each class. Questionnaires were administered to students who (a) did not have a diagnosed learning disability; (b) had provided their verbal consent; and (c) had written parent consent to participate. Given that administration of each survey was conducted on two separate days, only data from students that were present on both days was used. This provided a sample of 574 students. Of these students, 158 were in year 4, 252 were in year 5 and 164 were in year 6. Of the 574 students, 283 were male and 291 were female.

Three instruments were developed and validated for the purposes of this study; the Classroom Climate Questionnaire—Primary (to gather information about the learning environment from the students' perspective), the ICT Usage Survey (to assess students' use of ICT in the classroom) and the Self-Efficacy and Enjoyment Questionnaire (to assess three student outcomes of self-efficacy, enjoyment of class, and enjoyment of using ICT). The development of the three surveys involved six steps: (a) a review of related literature; (b) the selection and development of relevant scales; (c) the modification and development of survey items; (d) the selection of the response format; (e) a review by an expert panel; and (f) the pilot testing of the survey instruments.

The data collected from the sample of 574 students were analysed to address each of the research objectives of the present study. To address research objective 1, the examination of the construct validity of each instrument was guided by Trochim and Donnelly's (2008) construct validity framework. This framework helped to ensure that the content of the surveys was appropriate for the overall purpose of each survey. To provide evidence to support the criterion validity of the surveys in terms of convergent, discriminant, concurrent, and predictive validity, various analyses were carried out. Factor structure and scale reliability were examined separately for each instrument. An intercorrelation matrix generated during oblique rotation was used to provide evidence to support the discriminant validity between scales. An ANOVA was calculated for each scale to ensure concurrent validity. Finally, simple correlation was used to provide evidence to support the predictive validity of each instrument.

To address research objective 2, the differences between students' actual and preferred perceptions of their learning environment and the extent of ICT usage within the classroom were examined. Average item mean and average item standard deviation differences were calculated, MANOVAs were used to examine whether the differences were statistically significant, and effect sizes were calculated to examine the magnitude of the differences.

To investigate research objectives 3 and 4, the relationships among aspects of the learning environment, ICT usage, and the outcomes of student self-efficacy and enjoyment (both of class and use of ICT) were examined. Simple correlation analyses and multiple regression analyses were used for this purpose.

Research objective 5 examined whether differences existed in the learning environment perceptions and outcomes (self-efficacy, enjoyment of class, and enjoyment of using ICT) of male and female students and research objective 6 sought to examine whether differences existed for academically at-risk and not-at-risk students. First, to examine differences in these groups of students' perceptions MANOVA was used. Second, effect sizes were calculated to examine the magnitude of the differences between means (expressed as standard deviations), and the univariate one-way ANOVA was interpreted for each scale. Given that the two at-risk and not at-risk groups of students reported different experiences of the learning environment, an ANCOVA was used to examine the differences in the learning environment preferences.

Throughout the study, considerations were made and procedures were put in place to ensure that the research was carried out in an ethical manner. These considerations included ensuring that appropriate permissions and consents were obtained from CEWA, school principals, teachers, and parents. Student information sheets were provided and explained verbally to students to ensure that they were aware of their right to withdraw from the study at any time. Verbal consent was obtained from each student. Individual student results were kept confidential and were not made available to teachers. Individual class data confidentiality was maintained as class level data was revealed only to the class teacher and was not made available to principals. Data from the present study has been stored securely.

The validation results of all three instruments (related to research objective 1) are reported in the following chapter. Data analysis related to research objectives 2 to 6) is summarised in Chapter 5.

**ANALYSIS AND RESULTS:
RELIABILITY AND VALIDITY OF THE RESEARCH**

4.1 Introduction

Given that existing instruments pertinent to the present study were not available for use at the primary school level, a key aspect of this research was the development and validation of three instruments (for administration online) using the six steps outlined in the previous chapter (see Section 3.5.1). Central to the development of these instruments were the efforts to ensure that they were valid and reliable. Therefore, the first research objective of the present study was:

Research Objective 1

To develop and validate three surveys to assess primary school students’:

- a) Perceptions of the learning environment;
- b) Use of ICT; and
- c) Outcomes in terms of:
 - i. Self-efficacy;
 - ii. Enjoyment of their class; and
 - iii. Enjoyment of using ICT.

This chapter describes the validation of each of the three new instruments under the following major headings:

- Validation of the Classroom Climate Questionnaire—Primary (CCQ-P) (Section 4.2);
- Validation of the ICT Usage Survey (Section 4.3); and
- Validation of the Self-Efficacy and Enjoyment Questionnaire (SEEQ) (Section 4.4)

4.2 Validation of the Classroom Climate Questionnaire—Primary (CCQ-P)

As explained in Section 3.6.1.1 of Chapter 3, according to Trochim and Donnelly's (2008) construct validity framework, translation validity confirms that the operationalisation of a survey's constructs accurately represents its theoretical foundation and can be comprehended by the respondents. Criterion validity (as explained in Section 3.6.1.2 of Chapter 3) relates to the relationships between items within the survey and focuses on whether the operationalisation of the survey provides conclusions about these relationships that are expected based on theory (Trochim & Donnelly, 2008). This section (Section 4.2) describes the validity of the CCQ-P in terms of translation validity (Section 4.2.1) and criterion validity (Section 4.2.2).

4.2.1 Translation Validity of the CCQ-P

Translation validity includes two elements: content validity and face validity (Trochim & Donnelly, 2008). This section (Section 4.2.1) outlines the translation validity of the CCQ-P in terms of these two elements (Sections 4.2.1.1 and 4.2.1.2, respectively).

4.2.1.1 Content Validity

Content validity is concerned with whether a construct is theoretically robust and whether the survey items provide a complete representation of the construct (Velayutham et al., 2011). In the context of this study, establishing the content validity of the CCQ-P involved ensuring that the content of the questionnaire was appropriate for the overall purpose of the instrument (as recommended by Li and Sireci, 2013).

The first step in ensuring the content validity of the CCQ-P, a review of literature (summarised in Section 2.2 of Chapter 2) was conducted to identify aspects of the learning environment that are important in the primary school setting. During this step, existing instruments were reviewed to determine their suitability for the present study (as outlined in Section 2.2.3 of Chapter 2). The conclusion of this review was that no existing instruments were suitable for use in the present study. The second step involved the selection and development of the CCQ-P scales. Given the strong

reliability of the COLES designed by Aldridge, Fraser, et al. (2012; reviewed in Section 2.2.3.6 of Chapter 2), this instrument was considered to be a suitable starting point for the development of the new primary school-level survey. The scales of the COLES were scrutinised to evaluate the suitability of the 11 scales for the primary school setting. As a result, seven scales were drawn from the COLES for the development of the new instrument: Student Cohesiveness, Teacher Support, Equity, Involvement, Task Orientation, Personal Relevance, and Collaboration. Two further scales, Task Clarity and Responsibility for Learning, were developed for use in the present study. This resulted in a total of nine CCQ-P scales. Table 4.1 provides a brief description and sample item for each CCQ-P scale. Each scale is described below in more detail along with a justification for its inclusion in the new instrument.

The *Student Cohesiveness* scale was intended to assess the extent to which students know, help, and are supportive of each other. Learning is social in its nature, with knowledge being jointly constructed through intercommunication with peers (DeCorte, 2010; Dweck, 2013; Elliot & Dweck, 2013; Wentzel, 1998; Wentzel, Battle, & Looney, 2010). Therefore, the formation of connections and genuine rapport between peers is a vital element of the classroom climate (Goldbaum, Craig, Pepler, & Connolly, 2003; Goodenow, 1993; Stewart, 2003; Welsh, 2000; Wentzel, 1998). Students require opportunities to learn collaboratively, and the learning environment should be such that students feel supported by each other and feel safe to take risks without being fearful of harassment. As such, this scale gives teachers feedback on whether students feel that they have friends within the class and whether they deem their classroom environment to be safe and supportive.

The *Teacher Support* scale was intended to assess the extent to which students perceive that the teacher relates to and shows interest in them as well as the extent to which the students perceive that the teacher assists them to learn. Teacher support is described by Wang (2009, p. 242) as the “extent to which teachers are supportive, responsive, and committed to students’ well-being.” Bowlby’s (1982) attachment theory describes how we learn to relate to other human beings and how we seek relationships to meet our emotional needs. According to this theory, in order to learn, students require interpersonal relationships that are supportive and caring; they also need to feel that

Table 4.1. Description and sample item for each scale of the CCQ-P

| CCQ-P scale | Description | Sample item |
|-----------------------------|---|---|
| | <i>The extent to which ...</i> | |
| Student Cohesiveness | ... students know, help, and support each other. | I get on well with students in this class. |
| Teacher Support | ... the teacher is helpful, friendly, and shows interest in students. | The teacher cares about my feelings. |
| Equity | ... students feel that they are treated fairly and equally by the teacher. | I get the same encouragement from the teacher as other students do. |
| Task Clarity | ... instructions for tasks are explicit and clear so that students know what they need to do. | The instructions for tasks are clear. |
| Responsibility for Learning | ... teachers give students responsibility and encourage them to be independent in their learning. | I am encouraged to work independently. |
| Involvement | ... students take part in discussions, ask questions, and share thoughts and ideas. | I discuss my ideas in class. |
| Task Orientation | ... it is important to complete tasks and to stay focused on activities. | I pay attention during class. |
| Personal Relevance | ... class activities are made relevant to students' experiences outside of school. | What I learn in this class is useful. |
| Collaboration | ... students cooperate and work together on learning tasks. | In this class, there is teamwork. |

their teachers are involved with them. The bonds that students develop with their teacher are important for students' sense of belonging and connectedness at school, which, in turn, are essential for learning to occur (Aldridge et al., 2016; Rowe & Stewart, 2009). As such, teacher–student relationships are an important aspect of the learning environment and can have a deep impact on students' classroom experience (Dweck, 2013). Past research suggests that students who experience high levels of teacher support are more likely to work hard and be academically engaged (Aldridge, Afari, et al., 2012; Klem & Connell, 2004; Noddings, 1996; Strati, Schmidt, & Maier, 2017). Students experiencing high levels of teacher support also display fewer disruptive behaviours (Joyce & Early, 2014; Kidger, Araya, Donovan, & Gunnell, 2012; Loukas & Robinson, 2004; McDonald, 2013; Reinke & Herman, 2002) and are

more likely to persevere with tasks and ask for help (Marchand & Skinner, 2007), thus contributing to improved academic achievement (Marchand & Skinner, 2007).

The *Equity* scale was intended to assess the extent to which students perceive that the teacher encourages and includes them as much as their peers (Bell, 2013)—for example, the extent to which the teacher encourages and allows students to be involved in classroom discussions as frequently as their peers. This scale is based on the assertion that it is necessary for a classroom environment to provide equitable opportunities for all students to participate in their learning (Bell, 2013). In the educational context, equity does not always refer to students being treated equally; rather, it is about providing each student with equitable access to learning and an equal opportunity to achieve success (Milner, 2010; Rennie, 2005; Secada, 1995). In order to provide an equal chance of success, teachers need to incorporate a variety of strategies that cater for and are responsive to diverse student needs. In the Australian context, the importance of teaching strategies that cater for and are responsive to diverse student needs are recognised and outlined in Standards 1.3 to 1.6 of the AITSL standards for teachers (AITSL, 2014). This scale provides teachers with information about whether students perceive that they have equitable opportunities for learning (Aldridge, Fraser, et al., 2012).

The *Task Clarity* scale was intended to assess the extent to which students perceive that they understand the instructions and the goals of learning activities. It is important to ensure that students are clear about the learning intentions and what is required of them to complete tasks successfully (Hattie, 2009; Hollingsworth & Ybarra, 2009; McDonald, 2013). When students have clear goals and learning intentions, this directs their attention and effort (Gagné & Driscoll, 1975; Hattie, 2009). Students also require teachers to provide clear instructions, practice examples, and success criteria in order to enhance task clarity (Gagne, 1985; Hattie, 2012; Hollingsworth & Ybarra, 2009; McDonald, 2013; Westwood, 2004). Clear instructions and examples assist students in knowing what to do to complete a task and clear success criteria help them envisage what success will look like.

The *Responsibility for Learning* scale was intended to assess the extent to which students feel that they are provided with opportunities to learn independently and be

responsible for their own learning. It is crucial for teachers to create classroom environments and tasks that assist students to develop into independent, lifelong learners (Schunk & Zimmerman, 2013). Hattie (2012) has demonstrated that regardless of their academic abilities, students who do not learn to take responsibility for their own learning often experience difficulties with long-term success, such as when they reach tertiary level and are expected to learn independently. As such, students must be taught to set learning goals and to be responsible for self-monitoring and self-regulating as they work to achieve their goals (Hattie, 2012). Students must, therefore, be able to select appropriate and effective learning strategies, persevere when faced with challenges, and adapt or change strategies when their current strategies are not successful (Hattie, 2012). In the Western Australian context, the need for students to develop responsibility for their learning is supported by the Western Australian School Curriculum and Standards Authority (2014) principles of teaching and learning, whereby teachers are required to plan learning experiences that allow students to become more autonomous through ongoing opportunities to learn both independently and collaboratively.

The *Involvement* scale was intended to assess the extent to which students perceive that they are provided with opportunities to be an active participant in their own learning. When students are actively engaged in tasks, their learning is likely to be enhanced (Rodin, 1990; School Curriculum and Standards Authority, 2014; Skinner, 1996). The Involvement scale incorporates students' opportunities to learn through oral language: Given that learning is social in nature (Bronfenbrenner, 1979), language plays a pivotal role in learning, particularly in the primary years. Therefore, this scale relates to the opportunities that students have to participate in whole class and peer discussions. This participation in discussions is of value because active involvement in learning is required in order for knowledge to be constructed, thinking to be extended, and learning to be enhanced (Ahuja, 2016; Bruner, 1986; Hattie, 2012; McDonald, 2013; Vygotsky, 1972; Wright, 2015). According to Wright (2015), active learning opportunities empower students to make decisions about their learning, generate their own knowledge, and contextualise knowledge in relation to the real world.

The *Task Orientation* scale was intended to assess the extent to which students perceive that they have a clear understanding of the tasks and the importance that they place on

the completion of such tasks (Aldridge & Galos, 2017). Task orientation is important as, to engage in learning, students need to have a clear understanding of the task (Killen, 2000). Students who are more task oriented are more likely to be motivated to complete tasks (Killen, 2000; Spady, 1994; Wiggins & McTighe, 2005) and increase their skill or understanding (Midgley 2002; Midgley, Kaplan, Middleton, & Maehr, 1998). This scale also relates to students' ability to maintain their focus on completing tasks. In order to successfully complete tasks, students need to be able to concentrate on the task and, as such, require teacher reinforcement, such as attentional cues, to maximise on-task behaviour (Bell, 2013; Snell & Brown, 2000; Westwood, 2004).

The *Personal Relevance* scale was intended to assess the extent to which students feel that what they learn in the classroom is relevant to their lives outside of school. The importance of learning being relevant to students is highlighted in AITSL Standard 4, in which teachers are encouraged to engage students in purposeful activities (AITSL, 2014). When instruction within the learning environment is authentic, meaningful, and clearly connected to students' everyday lives, students are more likely to feel stimulated (Elliott, Hufton, Willis, & Illushin, 2005; Taylor et al., 1997) and learning is enhanced (Fisher, Denning, Higgins, & Loveless, 2012). To ensure relevance, educators need to not only address content and pedagogy (the what and the how of learning) but also consider why content or skills are being taught. As such, teachers should support students to find purpose in their learning so that students can create meaning and understand the world. In doing so, academic, social, and cultural success can be achieved (Milner, 2014).

The *Collaboration* scale was intended to assess the extent to which students have opportunities to work cooperatively with other students as part of their learning. Working cooperatively allows students to elucidate and articulate ideas and work together to find solutions (Johnson, Johnson, & Smith, 2007). The use of language to communicate with peers allows students to be involved in the explanation of concepts, which, in turn, provides opportunities for clarification of ideas and for students to learn from each other (Aldridge, Fraser, et al., 2012; School Curriculum and Standards Authority, 2014; Wentzel, 1998; Wentzel et al., 2010). Although it is recognised that students should be provided with opportunities to work independently (Slavin, 2010), it is equally necessary for them to learn collaboratively (Aldridge, Fraser, et al., 2012).

Having selected and developed appropriate scales for inclusion in the CCQ-P, the next stage in development of the CCQ-P involved the modification and development of the items. For each of the nine scales, the number of items was reduced from six items to five items (providing 45 items in total). The wording of the items that had been drawn from the COLES was also simplified in order to ensure face validity (outlined further in Section 4.2.1.2).

The next step involved the development of an appropriate response format. The items of the CCQ-P were responded to using a five-point frequency scale. The initial response format selected when the instrument was developed was *almost never*, *seldom*, *sometimes*, *often* and *almost always*; however, after a student pilot study (outlined further in Section 4.2.1.2), the response options were altered to *almost never*, *rarely*, *sometimes*, *often* and *almost always* (that is, the term *seldom* was simplified to *rarely*).

A side-by-side response format was used to enable students to provide information about their perceptions of the current classroom environment (the actual environment) as well as information about their ideal learning environment (their preferred environment). The actual–preferred response format was selected for two reasons. First, this format, commonly used in learning environment research (Fraser & Fisher, 1983b), is based on person-environment fit theory (Caplan, 1987; Fraser & Rentoul, 1980; French, Caplan & Harrison, 1982; O’Reilly, Chapman, & Caldwell, 1991). This theory proposes that individuals need to feel that they fit into their environment; past learning environment research suggests that the students achieve better results when they are able to learn in their preferred environment (Fraser, 1998a). Second, collecting data using this response format allows teachers to reflect on student feedback regarding their perceptions of their actual and preferred learning environments. This is helpful as teachers can assess perceptions of how students currently perceive their learning environment, how they would ideally like the learning environment to be, and take action to more closely match the actual and preferred environments. An example of the side by side format is provided in Figure 4.1.

| | ACTUAL | | | | | PREFERRED | | | | |
|------------------------------|--------------|--------|-----------|-------|---------------|--------------|--------|-----------|-------|---------------|
| BEING INVOLVED | Almost Never | Rarely | Sometimes | Often | Almost Always | Almost Never | Rarely | Sometimes | Often | Almost Always |
| I discuss my ideas in class. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |

Figure 4.1. Side-by-side response format (actual and preferred perceptions) used in the CCQ-P

The final step in the development of the CCQ-P involved a review of the instrument by an expert panel. The panel, consisting of eight experienced primary educators (all of whom had been teaching for more than 15 years)⁸, reviewed the draft CCQ-P scales and items as well as the response format. The panel members assessed and confirmed the content validity of the scales, deeming that the items were relevant to, and adequately covered, the construct that was intended to be measured by each scale. The feedback from the panel also related to face validity and is described in the section below.

4.2.1.2 Face Validity

To enhance the face validity of the draft instrument, care was taken during the development of scales and items in an attempt to ensure that the language would be familiar to primary school-aged students and that they would be able to comprehend the statements. To provide contextual cues that were relevant to primary aged students, the names of the scales that been taken from the COLES were simplified. For example, the Equity scale of the CCQ-P was referred to as Fairness on the version of this questionnaire that was administered to students. It was anticipated that providing meaningful contextual cues to students (such as these simplified scale names) would improve the face validity of the survey, increasing the likelihood that students could understand the meaning of the survey questions. According to Cohen, Manion, and Morrison (2011), enhancing the readability of the survey for students is important as

⁸ Further information about the composition of the expert panel can be found in Section 3.5.1.5 of Chapter 3.

any inability on the part of participants to comprehend or understand an instrument used to gather data threatens the validity of the research instrument.

Contextual cues were provided in the form of child-friendly names for eight of the nine scales). The Teacher Support scale name was retained as it was considered by the researcher to be a clear description of the scale and able to be comprehended by primary school students. The CCQ-P scales and the modified scale names used for students are provided in Table 4.2.

Table 4.2 CCQ-P scale names and corresponding contextual cues used in the survey presented to students

| CCQ-P Scales | Contextual cue used in the student version of the ICT Usage Survey |
|-----------------------------|--|
| Student Cohesiveness | Friendships |
| Teacher Support | Teacher Support |
| Equity | Fairness |
| Task Clarity | Knowing What to Do |
| Responsibility for Learning | Taking Responsibility |
| Involvement | Being Involved |
| Task Orientation | Getting My Work Done |
| Personal Relevance | Usefulness of What I Learn |
| Collaboration | Working Together |

The face validity of the CCQ-P was evaluated through the use of an expert review panel and a pilot study. In addition to addressing content validity (as described in Section 4.2.1.1), the expert panel members were asked to review the face validity of the draft scales and items of the CCQ-P. Specifically, the panel scrutinised the scales and items in terms of readability for primary age students and whether the items provided good coverage of the scale. The panel made suggestions with respect to the simplification of

the language of some items. For example, one of the items in the Personal Relevance scale began with the phrase *I can make links....* The panel felt that some students may not understand what a *link* was and suggested that the term *connections* may be more familiar for students. Given that the term *connections* is also used widely within the Western Australian curriculum, and would, therefore, be relevant to teachers, the item was changed to: *I can make connections between what I learn in this class and my life outside of school.* The panel also felt that the survey was, potentially, too long for primary school students. As a result of this feedback, some scales and items were omitted to shorten the length. This addressed both readability and the length of the questionnaire for primary school students.

The final step in the development of the CCQ-P involved a pilot study to examine the face validity of the newly-developed CCQ-P. In the pilot study, 30 year 4 students responded to the survey; six of these students were also interviewed. As explained in Section 3.5.1.6 of Chapter 3, year 4 students were selected as these were the youngest students that were likely to respond to the questionnaires in this study and therefore the most likely to experience difficulty in the comprehension of items due to their reading capabilities.

The pilot study was used to examine three aspects of the questionnaire: whether individual items were comprehended in ways that were intended by the researcher; the usability of the response format; and any technical issues related to the administration of the questionnaire. As a result of the pilot study and feedback from the review panel, some minor modifications were made which are outlined below.

To examine whether individual items were comprehended in ways that were intended by the researcher, the readability of the items was assessed during the pilot study. One item from the Teacher Support scale was simplified from *The teacher is interested in how I am feeling* to *The teacher cares about my feelings* as feedback from students indicated that they found the initial wording of the item to be difficult to understand as the term *interested* was vague. In another item, some of the students had difficulty understanding the term *tasks*. Therefore, the first item in the Task Clarity scale was changed to *I know what I have to do to complete my school work.*

The usability of the five-point frequency response format was examined through the pilot study. When questioned about their understanding of the terms used in the frequency scale, some of the students did not understand the term *seldom*, and as a result, this was changed to *rarely*. Students demonstrated a good understanding of the remaining four of the five terms. Students indicated that *almost always* meant “Pretty much always happens” or “Happens every time except for one or two times a day.” When questioned about what *often* meant, responses included “a lot” and “quite a bit.” Students perceived *sometimes* to mean “50–50” and “Happens a couple of times a week.” When questioned about the alternative term *rarely* they described this as “Happening occasionally like once a week” and “Happening a bit more often than almost never.” *Almost never* was perceived as “Happening a couple of times a month” and “Hardly ever happens.”

In addition to understanding the terms used in the frequency response format, the pilot test also indicated that year 4 students were able to use the response format appropriately to indicate the frequencies with which the items examined in the survey occurred. After the administration of the survey in the pilot test, students were interviewed about why they chose a certain response to an item to confirm that they had understood the response options correctly. For example, when asked why they had chosen *almost always* in response to the item *The teacher cares about my feelings*, one student articulated that “The teacher always wants to help people but may not want to be a busy-body.” When asked about their choice of *sometimes* in response to the item *The teacher helps me with my work*, one student explained, “Because most of the time I can do the work by myself.” When another student was asked why they had responded *often* to the same item, the student explained that “At times the teacher is busy helping other students and might run out of time to help me.” Although none of the students involved in the pilot test had used the responses *rarely* and *never*, their explanation of what these terms meant suggested that the students had sufficient understanding of the meaning of these responses.

The pilot test also examined whether students of primary school age could cope with the demands of answering each question twice (as required for the actual–preferred format; see Section 4.2.1.1). The following instructions were given to students prior to administration to help them to effectively use the actual–preferred format:

For some statements, there are two columns. The first column, ACTUAL, asks you about how often things happen in the classroom. The second column, PREFERRED, asks you to indicate how often you would like them to happen. If you are happy with what happens in the classroom for a particular statement, you would put the same response for actual and preferred.

When questioned at the conclusion of the survey about whether they had found the actual–preferred format difficult to understand, all six students indicated that they were able to understand the difference between the two sections. When asked what *actual* meant, students’ responses included “In your own opinion, what is actually happening right now” and “The truth.” When asked to explain their understanding of the term *preferred*, students’ responses included “What you would like to happen” and “If you created your own perfect classroom, how often would you like this to happen?”

No technical issues were identified during the pilot study. Students were easily able to login to the online survey and navigate through the questionnaire. When students omitted a response, they were not able to move to the next page until this was rectified; the missing response was highlighted in red to assist students in this respect.

Once adjustments had been made to the survey on the basis of the expert panel review and pilot study, the CCQ-P was administered to 609 students in 31 classes. As detailed in Section 3.6, a matched data sample of 574 students from the administration of all three surveys was used to examine the criterion validity of the CCQ-P; the results of this analysis are described in the next section (Section 4.2.2).

4.2.2 Criterion Validity of the CCQ-P

According to Trochim and Donnelly’s (2008) construct validity framework, criterion validity relates to the relationships between items within the survey and focuses on whether the operationalisation of the survey provides conclusions about these relationships that are expected based on theory. Four aspects of criterion validity were examined using the data from the administration of the three surveys, and the associated results are reported in this section: convergent validity (Section 4.2.2.1),

discriminant validity (Section 4.2.2.2), concurrent validity (Section 4.2.2.3), and predictive validity (Section 4.2.2.4).

4.2.2.1 Convergent Validity

Convergent validity examines whether the items of a single construct correlate highly with each other (Trochim & Donnelly, 2008). Investigating convergent validity involves measuring the strength of the relationships between those items that are expected to represent a single concept or construct (Brown, 2014). To provide evidence to support the convergent validity and reliability of each of the nine scales within the CCQ-P, the data collected from the matched sample of 574 students in 31 classes (as described in Sections 3.4 and 3.6 of Chapter 3) were analysed using item and factor analyses and Cronbach's alpha coefficient as a measure of internal consistency reliability. All analyses were conducted separately for the students' actual and preferred responses.

As a first step, the multivariate normality and sampling adequacy of the actual and preferred versions of the data collected using the CCQ-P were tested. The results of Bartlett's test of sphericity indicated that the chi-square values were 29,772.034 for the actual version and 34,497.794 for the preferred version. In both cases, these values were statistically significant ($p < .001$). Further, the Kaiser-Meyer-Olkin measures of adequacy were high (.959 for the actual version and .969 for the preferred version), suggesting that both data sets were appropriate for further analysis.

Exploratory factor analysis was subsequently carried out to extract salient factors from the two versions of the CCQ-P. The term factor analysis "refers to a variety of statistical techniques whose common objective is to represent a set of variables in terms of a smaller number of hypothetical variables" (Kim & Mueller, 1982, p. 9). Given that survey responses provided by human participants are correlated, oblique rotation is recommended to allow a set of relevant factors to be identified (Field, 2009). As such, principal axis factoring with oblique rotation was conducted to examine the factor structure of the 45-item, nine-scale CCQ-P. As noted in Section 3.6.1.2 of Chapter 3, the two criteria used for retaining an item were that the item must have a factor loading of at least .40 on its own scale and a loading of less than .40 on any of the other scales

(Field, 2009; Stevens, 1992; Thompson, 2004). The results of the factor analysis are reported in Table 4.3 (for the actual version of the CCQ-P) and Table 4.4 (for the preferred version of the CCQ-P).

The factor loadings for students' responses to the actual version of the CCQ-P (reported in Table 4.3), indicated that all of the items loaded above .40 (the lowest being .41) on their respective factors and did not load on any other factor, with one exception. The exception, item four within the Student Cohesiveness scale, loaded on its own scale at .58 as well as on the Teacher Support scale at .55. Given that further analyses indicated that, by omitting this item, the reliability estimates for this scale would have been reduced, the decision was made to retain this item.

Whereas factor loadings reveal how strongly each item is related to a given factor, eigenvalues indicate the relative importance of each factor, and the cumulative variance can be utilised to assess whether a satisfactory number of factors have been retained (Field, 2009). For the actual version of the CCQ-P, the eigenvalue for each factor was greater than 1, as recommended by Kaiser (1974); as shown at the bottom of Table 4.3, the eigenvalues ranged from 1.05 to 15.22 for the different scales. The percentage of the total variance that was extracted with each factor varied from 2.33% to 33.82% for the different scales; the cumulative variance for all factors was 65.88%. Each variance result satisfied Kaiser's (1960) recommendation that the eigenvalue for a factor should be greater than 1.

The factor loadings for the preferred version of the CCQ-P (reported in Table 4.4) indicated that all items loaded at above .40 on their respective factors (the lowest loading being .41) and did not load at .40 or above on any other factor. As such, all of the items were retained. The eigenvalue for each factor was greater than 1, as recommended by Kaiser (1974); as shown at the bottom of Table 4.4, the eigenvalues ranged from 1.05 to 17.04 for the different scales. The percentage of the total variance that was extracted with each factor varied from 2.1% to 38.67% for the different scales; the cumulative variance for all factors was 70.03%. Each variance result satisfied Kaiser's (1960) recommendation that the eigenvalue for a factor should be greater than 1.

Table 4.3. Factor loadings, eigenvalues, and percentages of variance explained for the actual version of the CCQ-P

| Item | Factor Loadings | | | | | | | | |
|------|----------------------|-----------------|--------|--------------|-----------------------------|-------------|------------------|--------------------|---------------|
| | Student Cohesiveness | Teacher Support | Equity | Task Clarity | Responsibility for Learning | Involvement | Task Orientation | Personal Relevance | Collaboration |
| 1 | .81 | | | | | | | | |
| 2 | .78 | | | | | | | | |
| 3 | .61 | | | | | | | | |
| 4 | .58 | .55 | | | | | | | |
| 5 | .77 | | | | | | | | |
| 6 | | .51 | | | | | | | |
| 7 | | .70 | | | | | | | |
| 8 | | .66 | | | | | | | |
| 9 | | .70 | | | | | | | |
| 10 | | .61 | | | | | | | |
| 11 | | | .64 | | | | | | |
| 12 | | | .52 | | | | | | |
| 13 | | | .73 | | | | | | |
| 14 | | | .72 | | | | | | |
| 15 | | | .79 | | | | | | |
| 16 | | | | .70 | | | | | |
| 17 | | | | .72 | | | | | |
| 18 | | | | .68 | | | | | |
| 19 | | | | .58 | | | | | |
| 20 | | | | .67 | | | | | |
| 21 | | | | | .81 | | | | |
| 22 | | | | | .47 | | | | |
| 23 | | | | | .59 | | | | |
| 24 | | | | | .71 | | | | |
| 25 | | | | | .74 | | | | |

| Item | Factor Loadings | | | | | | | | |
|-------------|----------------------|-----------------|--------|--------------|-----------------------------|-------------|------------------|--------------------|---------------|
| | Student Cohesiveness | Teacher Support | Equity | Task Clarity | Responsibility for Learning | Involvement | Task Orientation | Personal Relevance | Collaboration |
| 26 | | | | | | .61 | | | |
| 27 | | | | | | .68 | | | |
| 28 | | | | | | .73 | | | |
| 29 | | | | | | .68 | | | |
| 30 | | | | | | .41 | | | |
| 31 | | | | | | | .73 | | |
| 32 | | | | | | | .68 | | |
| 33 | | | | | | | .73 | | |
| 34 | | | | | | | .68 | | |
| 35 | | | | | | | .41 | | |
| 36 | | | | | | | | .87 | |
| 37 | | | | | | | | .71 | |
| 38 | | | | | | | | .73 | |
| 39 | | | | | | | | .81 | |
| 40 | | | | | | | | .86 | |
| 41 | | | | | | | | | .72 |
| 42 | | | | | | | | | .61 |
| 43 | | | | | | | | | .73 |
| 44 | | | | | | | | | .74 |
| 45 | | | | | | | | | .56 |
| Eigenvalues | 2.29 | 1.47 | 1.05 | 2.94 | 1.74 | 15.22 | 1.17 | 1.97 | 1.79 |
| % Variance | 5.09 | 3.26 | 2.33 | 6.53 | 3.87 | 33.82 | 2.61 | 4.39 | 3.98 |

Factor loadings smaller than .40 have been omitted.
N = 574 students in 31 classes.

Table 4.4. Factor loadings, eigenvalues, and percentages of variance explained for the preferred version of the CCQ-P

| Item | Factor Loadings | | | | | | | | |
|------|----------------------|-----------------|--------|--------------|-----------------------------|-------------|------------------|--------------------|---------------|
| | Student Cohesiveness | Teacher Support | Equity | Task Clarity | Responsibility for Learning | Involvement | Task Orientation | Personal Relevance | Collaboration |
| 1 | .81 | | | | | | | | |
| 2 | .80 | | | | | | | | |
| 3 | .61 | | | | | | | | |
| 4 | .73 | | | | | | | | |
| 5 | .68 | | | | | | | | |
| 6 | | .81 | | | | | | | |
| 7 | | .54 | | | | | | | |
| 8 | | .52 | | | | | | | |
| 9 | | .49 | | | | | | | |
| 10 | | .80 | | | | | | | |
| 11 | | | .68 | | | | | | |
| 12 | | | .64 | | | | | | |
| 13 | | | .76 | | | | | | |
| 14 | | | .76 | | | | | | |
| 15 | | | .75 | | | | | | |
| 16 | | | | .73 | | | | | |
| 17 | | | | .75 | | | | | |
| 18 | | | | .71 | | | | | |
| 19 | | | | .61 | | | | | |
| 20 | | | | .76 | | | | | |
| 21 | | | | | .86 | | | | |
| 22 | | | | | .42 | | | | |
| 23 | | | | | .64 | | | | |
| 24 | | | | | .81 | | | | |
| 25 | | | | | .81 | | | | |

| Item | Factor Loadings | | | | | | | | |
|-------------|----------------------|-----------------|--------|--------------|-----------------------------|-------------|------------------|--------------------|---------------|
| | Student Cohesiveness | Teacher Support | Equity | Task Clarity | Responsibility for Learning | Involvement | Task Orientation | Personal Relevance | Collaboration |
| 26 | | | | | | .79 | | | |
| 27 | | | | | | .77 | | | |
| 28 | | | | | | .63 | | | |
| 29 | | | | | | .66 | | | |
| 30 | | | | | | .73 | | | |
| 31 | | | | | | | .78 | | |
| 32 | | | | | | | .66 | | |
| 33 | | | | | | | .64 | | |
| 34 | | | | | | | .66 | | |
| 35 | | | | | | | .58 | | |
| 36 | | | | | | | | .83 | |
| 37 | | | | | | | | .74 | |
| 38 | | | | | | | | .77 | |
| 39 | | | | | | | | .83 | |
| 40 | | | | | | | | .84 | |
| 41 | | | | | | | | | .74 |
| 42 | | | | | | | | | .60 |
| 43 | | | | | | | | | .81 |
| 44 | | | | | | | | | .70 |
| 45 | | | | | | | | | .71 |
| Eigenvalues | 1.41 | 1.44 | 1.05 | 17.40 | 1.98 | 2.92 | 1.10 | 2.56 | 1.76 |
| % Variance | 3.13 | 3.20 | 2.10 | 38.67 | 4.40 | 6.49 | 2.44 | 5.68 | 3.92 |

Factor loadings smaller than .40 have been omitted.
N = 574 students in 31 classes.

Overall, the data for both the actual and preferred versions of the questionnaire provided strong support for the factorial validity of the 45-item, nine-scale Classroom Climate Questionnaire—Primary (CCQ-P). Having established the factorial validity of the questionnaire, the next step was to examine the internal consistency reliability of each of the nine scales.

To examine whether the items in each scale measured the same construct, the Cronbach's alpha coefficient was utilised as an index of internal consistency reliability. This coefficient was calculated for each CCQ-P scale for each of two units of analysis (the individual responses and the mean class responses). As shown in Table 4.5, the alpha coefficients for the CCQ-P scales were high for both the actual and preferred versions. For the actual version, with the individual as the unit of analysis, the alpha coefficients ranged from .81 to .91 for the different CCQ-P scales; with the class mean as the unit of analysis, the coefficients ranged from .78 to .93. For the preferred version, the alpha coefficients of different CCQ-P scales ranged from .83 to .92 with the individual as the unit of analysis. Using the class mean as the unit of analysis, scale reliability estimates ranged from .82 to .94. According to Cohen, Manion, and Morrison (2011), the alpha coefficient for a satisfactory scale should be .70 or higher. Given this guideline, these alpha reliability estimates support the internal consistency of all of the scales of the CCQ-P.

Overall, the factor loadings and internal consistency results indicate that the items within each CCQ-P scale were highly correlated with each other. As such, these results provide evidence to support the convergent validity of the questionnaire.

Table 4.5. Internal consistency reliability (Cronbach's alpha coefficient) for the scales of the actual and preferred versions of the CCQ-P

| Scale | Unit of analysis | Cronbach's alpha coefficient | |
|-----------------------------|------------------|------------------------------|-----------|
| | | Actual | Preferred |
| Student Cohesiveness | Individual | .81 | .85 |
| | Class Mean | .82 | .89 |
| Teacher Support | Individual | .84 | .83 |
| | Class Mean | .93 | .82 |
| Equity | Individual | .88 | .89 |
| | Class Mean | .92 | .89 |
| Task Clarity | Individual | .88 | .92 |
| | Class Mean | .90 | .93 |
| Responsibility for Learning | Individual | .82 | .83 |
| | Class Mean | .78 | .86 |
| Involvement | Individual | .87 | .90 |
| | Class Mean | .91 | .93 |
| Task Orientation | Individual | .84 | .89 |
| | Class Mean | .89 | .93 |
| Personal Relevance | Individual | .91 | .92 |
| | Class Mean | .92 | .94 |
| Collaboration | Individual | .82 | .87 |
| | Class Mean | .88 | .89 |

N = 574 students in 31 classes.

4.2.2.2 Discriminant Validity

To have satisfactory discriminant validity, the items related to different constructs should not correlate highly with each other (Trochim & Donnelly, 2008). Discriminant validity is concerned with the extent to which a scale represents a distinct construct: The construct measured by a particular scale should not also be included in any other scales of the instrument. Discriminant validity is demonstrated when the correlations between any given item and the other items in the same construct are greater than the correlations between that item and the items from different constructs (Trochim & Donnelly, 2008).

Discriminant validity is achieved when correlations between an item and other items in the same scale are greater than correlations between the items from different scales (Trochim & Donnelly, 2008). Based on theoretical grounds, Field (2009) has suggested that the relationship between factors should be moderately strong; Brown (2014) has indicated that factor correlations above .80 imply an overlap of concepts and, therefore, suggest poor discriminant validity. Given that oblique rotation in exploratory factor analysis provides a realistic representation of the interrelatedness of factors, thus giving an indication of discriminant validity, the component correlation matrix, generated during analysis was utilised (Brown, 2014; Field, 2009). In the case of the CCQ-P, analysis of the component correlation matrix obtained from oblique rotation (reported in Table 4.6) demonstrated that the highest correlation between any two scales was .58 for the actual version and .47 for the preferred version. These correlations thus supported the discriminant validity of the CCQ-P.

4.2.2.3 Concurrent Validity

Concurrent validity considers the extent to which the survey scales can distinguish between groups of participants that, theoretically, should be distinguished between (Trochim & Donnelly, 2008). In the context of this study, to assess whether the actual form of each CCQ-P scale could satisfactorily differentiate between the perceptions of students in different classes, an ANOVA was conducted for each scale with class membership used as the independent variable. The preferred form was not included in this analysis as, theoretically, students' preferences were unlikely to differ between classes.

The ANOVA results, reported in Table 4.7, indicated that the η^2 values varied between .06 and .11 for the different CCQ-P scales. Further, all of the scales, with exception of two (Student Cohesiveness and Equity), were able to differentiate satisfactorily between classes ($p < .05$). Overall, the results suggested that (with the exception of the Student Cohesiveness and Equity scales) students within the same class perceived the classroom learning environment in a relatively similar manner, whereas the perceptions of students in different classes varied.

Table 4.6. Component correlation matrix for the scales of the actual and preferred versions of the CCQ-P

| Scale | Cohesiveness | Teacher Support | Equity | Task Clarity | Responsibility | Involvement | Task Orientation | Relevance | Collaboration |
|------------------|--------------|-----------------|--------|--------------|----------------|-------------|------------------|-----------|---------------|
| Cohesiveness | – | .28 | .41 | .58 | .38 | .37 | .40 | .30 | .56 |
| Teacher Support | .28 | – | .31 | .17 | .44 | .29 | .24 | .49 | .26 |
| Equity | .36 | .41 | – | .43 | .41 | .26 | .44 | .30 | .47 |
| Task Clarity | .33 | .35 | .41 | – | .26 | .20 | .37 | .17 | .33 |
| Responsibility | .42 | .17 | .29 | .22 | – | .29 | .30 | .36 | .44 |
| Involvement | .34 | .23 | .40 | .28 | .33 | – | .30 | .28 | .39 |
| Task Orientation | .43 | .31 | .35 | .30 | .30 | .34 | – | .24 | .49 |
| Relevance | .45 | .25 | .46 | .43 | .30 | .47 | .36 | – | .26 |
| Collaboration | .43 | .44 | .35 | .34 | .20 | .28 | .44 | .30 | – |

N = 574 students in 31 classes.

Correlations for the actual version are represented above the diagonal; correlations for the preferred version are represented below the diagonal.

Table 4.7. Ability to differentiate between classes (ANOVA results) for each scale of the CCQ-P (based on responses to the actual version)

| Scale | ANOVA results (eta ²) |
|-----------------------------|-----------------------------------|
| Student Cohesiveness | .06 |
| Teacher Support | .08** |
| Equity | .06 |
| Task Clarity | .07** |
| Responsibility for Learning | .10** |
| Involvement | .10** |
| Task Orientation | .07* |
| Personal Relevance | .08* |
| Collaboration | .11** |

N = 574 students in 31 classes.

p* < .05; *p* < .01

4.2.2.4 Predictive Validity

Predictive validity considers the extent to which survey scales are able to predict something that they should, theoretically, be able to predict (Trochim & Donnelly, 2008). Previous studies have suggested that the classroom environment is an effective predictor of student self-efficacy (Bell & Aldridge 2014; Dorman 2001). For the purpose of the present study, a Self-Efficacy scale was modified from the Attitudes and Self-Belief Survey (ASBS) developed and validated by Bell and Aldridge (2014). The modified five-item scale included items such as *I can understand what the teacher tells me*.

The simple correlation results, reported in Table 4.8, indicated that all nine scales of the CCQ-P were statistically significantly (*p* < .01) correlated with student self-efficacy. These results supported the predictive validity of the CCQ-P.

This section (Section 4.2) has outlined the process used in the present study to gather evidence to support translation and criterion validity of the CCQ-P. Translation validity ensures that the operationalisation of the survey constructs accurately reflects its theoretical foundation and can be comprehended by the respondents and criterion validity relates to the relationships between items within the survey and focuses on

Table 4.8. Pearson correlations between Self-Efficacy and the scales of the CCQ-P

| CCQ-P Scale | Pearson correlation (one-tailed) |
|-----------------------------|----------------------------------|
| Student Cohesiveness | .41** |
| Teacher Support | .15** |
| Equity | .31** |
| Task Clarity | .56** |
| Responsibility for Learning | .38** |
| Involvement | .45** |
| Task Orientation | .54** |
| Personal Relevance | .38** |
| Collaboration | .42** |

N = 574 students in 31 classes.

** $p < .01$.

whether the operationalisation of the survey provides conclusions about these relationships that are expected based on theory (Trochim & Donnelly, 2008). The results of both the translation (Section 4.2.1) and criterion validity measures (Section 4.2.2), as suggested by Trochim and Donnelly (2008), provided strong support for the use of the 45-item, nine-scale CCQ-P with primary school students to assess their perceptions of their learning environment. The following section (Section 4.3) describes the process used in the present study to gather evidence to support the validation of the ICT Usage Survey.

4.3 Validation of the Information and Communication Technology (ICT) Usage Survey

The ICT Usage Survey was developed for use in this study (see Section 3.5.1 of Chapter 3). The survey was intended to provide a tool for teachers in primary school classrooms to gather information about their students' ICT use in the classroom (research objective 1). This section (Section 4.3) provides evidence to support the validity of the ICT Usage Survey. As was done for the CCQ-P in Section 4.2, the evidence in this section is organised in relation to translation and criterion-related aspects of validity (Sections 4.3.1 and 4.3.2, respectively).

4.3.1 Translation Validity of the ICT Usage Survey

This section outlines the evaluation of the translation validity of the ICT Usage Survey. This section reports on translation validity in terms of both content validity (Section 4.3.1.1) and face validity (Section 4.3.1.2). As detailed in Section 3.5.1.1 of Chapter 3, the development of this instrument was based on a review of the literature in relation to ICT as well as the ICT general capability within the Australian Curriculum (ACARA, n.d.).⁹

4.3.1.1 Content Validity

The first step in ensuring the content validity of the ICT Usage Survey, a review of literature (summarised in Section 2.3 of Chapter 2) was conducted to identify aspects of the use of ICT within the classroom that are important in the primary school setting. During this step, the ICT general capability from the Australian Curriculum was examined as foundation for the ICT Usage Survey (as outlined in Section 2.3.1 of Chapter 2). During this review it was established that no existing instruments were suitable for use or modification in the present study.

The second step involved the selection and development of the ICT Survey scales. To establish the content validity of the newly developed ICT Usage Survey, it was necessary to ensure that the content of the survey aligned with the overall intent of the survey. As such, the items and scales within the ICT Usage Survey aimed to assess the degree to which students perceive that they use ICT within the classroom. To assess these student perceptions, the scales of the newly-developed survey examined the five organising elements of the ICT general capability from the Australian Curriculum: Investigating with ICT, Creating with ICT, Communicating with ICT, Applying Social and Ethical Protocols and Practices, Managing and Operating ICT Effectively, and Changing Trends (refer to Figure 2.1 in Section 2.3.1). Table 4.9 provides a brief description and sample item for each ICT Usage Survey scale. A description of each scale in more detail is provided below with a justification for its inclusion in the new instrument.

⁹ For a review of literature related to ICT see Section 2.3 of Chapter 2.

Table 4.9. Description and sample item for each scale of the ICT Usage Survey

| ICT Usage Survey scale | Description | Sample item |
|---|--|--|
| | <i>The extent to which ...</i> | |
| Investigating with ICT | ... students define and plan information searches; locate, generate, and access data and information; and select and evaluate data and information. | My teacher helps me to look for information to solve a problem using ICT. |
| Creating with ICT | ... students generate ideas; plan and process; and generate solutions to challenges and learning tasks. | My teacher helps me to use a range of ICT to generate solutions to problems. |
| Communicating with ICT | ... students collaborate, share, exchange, and understand computer-mediated communications. | I use electronic communication to work with other students. |
| Applying Social and Ethical Protocols and Practices | ... students recognise intellectual property; apply digital information security practices; apply personal security protocols; and identify the impacts of ICT in society. | In this class, I am reminded to acknowledge or give credit to the source if I use someone else's work. |
| Managing and Operating ICT Effectively | ... students select and use hardware and software effectively; understand ICT systems; and manage digital data. | In this class, I edit digital photos or other images and insert them into documents. |
| Changing Trends | ... students perceive that ICT has altered the way teaching and learning occur in this class. | In this class, we do tasks that would not have been possible without computers. |

The *Investigating with ICT* scale of the ICT Usage Survey was intended to assess the extent to which students perceive that their teacher assists them to plan online searches, develop search criteria, look for information online, and evaluate information using ICT. Investigating with ICT refers to the process of investigating questions or problems using technology. The scale was intended to assess the perceptions of students in relation to how often they use ICT to search for information using a variety of online sources and analysing and evaluating the information that they locate through these searches (ACARA, n.d.).

In relation to the Investigating with ICT scale, the use of ICT by students within the classroom to search for, interact with, and analyse information aligns with a change in the culture of learning—supported by curriculum developers—from a transmission-of-knowledge approach towards a more learner-centred approach (Echazarra, Salinas, Méndez, Denis, & Rech, 2016; Maharaj-Sharma et al., 2017; Mitev & Crowther, 2008; Pearson, 2006; Romeo, 2006; Wong et al., 2006). The internet is an ICT tool which affords a change in culture, placing learning in the hands of students as they search for and synthesise information (Byrne & Brodie, 2012; Echazarra et al., 2016; Mitev & Crowther, 2008). Technology provides a means for all people to participate in this acquisition of knowledge, providing greater and faster access to global information, particularly for those in rural and remote communities (Mitev & Crowther, 2008; Sasman, 2013). Given that we are living in a knowledge-driven society (Aesaert et al., 2015; Rahman, 2008), students require the ability to use advancing and changing technologies to participate in global networks and access and analyse information to acquire knowledge. For these reasons, the Investigating with ICT scale was included in the ICT Usage Survey.

The *Creating with ICT* scale was intended to assess the extent to which students perceive that their teacher assists them to record and generate ideas using a variety of forms of ICT, be creative, and create solutions with ICT. This scale is based on the Creating with ICT general capability within the Australian Curriculum which involves students using digital technologies to generate ideas and create solutions to challenges (ACARA, n.d.). When using ICT, learners can select various pathways to make sense of ideas and can express their learning in a variety of ways (Gross, MacLeod, & Pretorius, 2001). Digital technologies can be powerful tools for representing, presenting and publishing information in differing, creative and dynamic ways (Binkley et al., 2012; Byrne & Brodie, 2012). Participation in a 21st century society requires creativity skills, which are also an element of digital literacy (Echazarra et al., 2016). To actively participate in society and to achieve social cohesion and personal fulfilment, individuals require the ability not only to investigate and communicate using ICT but also to create using ICT (Aesaert et al., 2015, Fraillon et al., 2014). This ability to create using ICT is a key competency for lifelong learning. Before one can communicate and share knowledge using ICT, one must be able to create using ICT

in order to present the information gathered (Fraillon et al., 2014). Hence, the Creating with ICT scale was considered to be an important inclusion in the present study.

The *Communicating with ICT* scale was intended to assess the extent to which students perceive that their teacher assists them to communicate with their peers and teachers using ICT as well as the extent to which they share their work and ideas with others using ICT. This scale is based on the Communicating with ICT general capability within the Australian Curriculum which involves students using technology to share ideas and information to communicate with others and collaboratively construct knowledge and digital solutions (ACARA, n.d.). Technology allows individuals to communicate with others regardless of time or place (Dunn & Marinetti, 2008; Mitev & Crowther, 2008). In the classroom context, technology promotes connections between students and their peers, teachers, and wider networks that may not have previously been possible (Byrne & Brodie, 2012; Gillespie, 2006; Mitev & Crowther, 2008). For example, students and teachers can now send files and documents via email or communicate and collaborate on tasks through online learning platforms; these uses of ICT can enhance learning and the inquiry process (Ahuja, 2016; Binkley et al., 2012). Life in the 21st century requires effective communication and collaborative problem-solving skills (Ahuja, 2016; Binkley et al., 2012; Echazarra et al., 2016; Maharaj-Sharma et al., 2017); as such, schools must ensure that students are equipped with adequate digital literacy skills to meet this challenge. Therefore, the inclusion of the Communicating with ICT scale in the ICT Usage Survey was considered to be important.

The *Applying Social and Ethical Protocols and Practices* scale was intended to assess the extent to which students acknowledge intellectual property, apply digital security protocols and personal security practices, and are aware of the impact of ICT on society (ACARA, n.d.). The Applying Social and Ethical Protocols and Practices scale was based on the general capability of the same name in the Australian curriculum and involves students understanding the social and ethical practices related to ICT use and applying these to recognise the digital intellectual property of others. This scale also relates to students safely and securely storing digital information (including personal information and passwords), and use of appropriate and ethical social protocols when creating and communicating using ICT.

Social and ethical protocols and practices for the use of ICT have evolved as technologies and their applications have developed and, as such, it is important for students to be aware of these evolving protocols and practices when using ICT. It is important for educators to not only teach students how to effectively use ICT but also to teach students how to positively interact with others when using technology; for example, this latter type of teaching may include addressing online ethics (Ahuja, 2016; Gross et al., 2001). The internet allows for anonymity of communication, and this anonymity can circumvent the normal societal disciplinary practices and surveillance mechanisms. As such, cyber safety is an essential skill for students to develop so that they can protect themselves from online bullying, fraud, and privacy violations (Ahuja, 2016; Mitey & Crowther, 2008; Organisation for Economic Co-operation and Development [OECD], 2015). When using ICT to investigate questions or problems, students must also develop the abilities to critically analyse information and identify trustworthy sources as well as understand how to acknowledge online and digital sources (OECD, 2015). For the reasons outline above, the inclusion of the Applying Social and Ethical Protocols and Practices scale was considered to be of value in the present study.

The *Managing and Operating ICT* scale was intended to assess the extent to which students are able to select and utilise software and hardware, understand ICT systems, and manage digital data. The Managing and Operating ICT scale refers to students' ability to proficiently manage and operate digital technologies in order to investigate, create, and communicate information. This scale relates to students' proficiencies in selecting, using, and troubleshooting varied and appropriate technologies (including hardware, software, and ICT systems) as well as students' ability to securely and efficiently manage and maintain digital data. This scale is based on the Managing and Operating ICT element within the ICT general capability in the Australian Curriculum. Of the various elements of the ICT capability in the Australian Curriculum, managing and operating ICT is the element that is the most explicitly integrated with the Technologies learning area, in which core digital technology skills such as the ability to use a range of software applications and digital hardware are developed, strengthened, and extended (ACARA, n.d.).

The ability to effectively manage and operate ICT is an important skill for students to acquire. Although technology has automated many tasks, computers are still ultimately dependent on the ability of the operator (Frey & Osborne, 2017) and therefore, students who do not develop effective digital skills will be unable to fully engage in the cultural, social, and economic society of the 21st century (Echazarra et al., 2016; OECD, 2015; Valtonen et al., 2015). Past research has indicated that people's ICT competencies (in terms of their ability to manage and operate ICT efficiently and effectively) are linked to the degree of benefit that they experience from technology use. For example, people who are digitally skilled are more likely to access online public services more often (Hargittai & Hinnant, 2008) and are more likely to access websites that can effectively influence their social, educational and financial outcomes (Aesaert & van Braak, 2014). As technologies have evolved, expectations of the basic skills and knowledge required for the workforce have altered in terms of the expectations of employers in relation to digital capabilities (OECD, 2015); as such, educators need to equip students with the skills necessary for them to be able to effectively manage and operate a variety of technologies for their future work life and, therefore, to be productive in modern society (Byrne & Brodie, 2012; OECD, 2015; Siddiq et al., 2016).

The *Changing Trends* scale was intended to assess the extent to which ICT has affected the types of tasks that students do at school and whether any such changes have enhanced students' experiences of learning. It should be noted that, although Changing Trends featured as an organising element within the ICT general capability in earlier versions of the Australian Curriculum, in more recent versions this element was omitted; therefore, this element does not appear in Figure 2.1 (in Section 2.3.1 of Chapter 2). The Changing Trends capability relates to the skills and understandings that are necessary for people to not only manage and operate current technology but also to adapt in order to be able to effectively use technologies that are rapidly changing and evolving.

The ability of students to adapt to the changing trends of technology is important for their future education, employment opportunities and participation in a 21st century society. The shift over time from an industrial to a knowledge-based society and economy has altered the skill demands of many occupations (Griffin, Care, & McGaw,

2012). The ways in which we think and work, along with the tools we use, are almost unrecognisable when compared to those of several decades ago (Binkley et al., 2012; Griffin et al., 2012). Moreover, these approaches and tools are likely to continue to change at rapid rates over the next few decades, further changing the composition of the workforce and resulting in new occupations (Binkley et al., 2012; Griffin et al., 2012). Frey and Osborne (2017) suggest that although automation and technology have resulted in workforce redundancies, human labour has remained as necessary due to our capability to utilise education to adopt and acquire new knowledge and skills. Given this capability to adopt and acquire new knowledge and skills, life in a digital twenty-first century requires that people have the ability to adapt to changing technological uses and trends (Binkley et al., 2012; Echazarra et al., 2016). Bernard (2012) claims that today's education systems must evolve so that they can effectively respond to the rapidly changing demands of society. As students are presented with new methods of digital participation in life, they must continue to develop new and evolving digital competencies and, hence, must be provided with opportunities to learn to utilise a range of technologies in multiple settings and for various purposes (OECD, 2015). Students require the ability to use ICT to enhance their understanding of the world using methods and technology that educators cannot yet imagine (Byrne & Brodie, 2012; Gross et al., 2001) and must therefore be able to adapt to changing technologies. As a result of the reasons outlined above, the Changing Trends scale was considered to be a necessary inclusion in the ICT Usage Survey.

The review of literature (outlined above and in Section 2.3 of Chapter 2) pertinent to ICT use provided a strong theoretical foundation for the development of the ICT Usage Survey and, thus, contributing to the content validity of the survey. Both the Investigating with ICT and Managing and Operating ICT Effectively scales included six items. The Creating with ICT scale included seven items, Communicating with ICT had eight items, Applying Social and Ethical Protocols and Practices had five items, and Changing Trends had four items. In total, the survey contained 36 items. To ensure consistency across the three instruments used in this study, students responded to the items using the same five-point frequency response format of *almost never*, *rarely*, *sometimes*, *often*, and *almost always*. The efficacy of using this five-point frequency scale was examined during a pilot study (outlined in Section 4.2.1.2). Three of the five scales of the ICT Usage Survey—Investigating with ICT,

Communicating with ICT, and Creating with ICT—involves an actual–preferred response format. This format enabled students to provide information about their perceptions of the current level of ICT integration in the classroom (the actual environment) as well as information about their ideal level of ICT use in the learning environment (their preferred environment) for these three scales. The remaining scales used the actual format only (see Appendix 4 for a copy of the survey used in the study).

In addition to this strong theoretical foundation, the content validity was further addressed through the input of the same expert review panel that was used with the CCQ-P. As with the CCQ-P, the panel consisted of eight experienced primary educators (two of whom were experts in the integration of ICT in classrooms). The panel members reviewed the draft scales and items for the ICT Usage Survey to ensure that the items were relevant to and adequately covered the construct that each scale was intended to assess.

As with the CCQ-P, feedback from the expert panel provided valuable information about the appropriateness of the items. For example, in the Applying Social and Ethical Protocols and Practices scale, it was suggested that additional information should be added to one item to explain what acknowledging a source meant. Therefore, the phrase *or give credit to* was added to the following item: *I am reminded to acknowledge or give credit to the source if I use someone else's work.*

This section (Section 4.3.1.1) outlined the process used in the present study to gather evidence to support the content validity of the ICT Usage Survey. The following section (Section 4.3.1.2) describes the process used in the present study to gather evidence to support the face validity of the ICT Usage Survey.

4.3.1.2 Face Validity

This section discusses the face validity of the ICT Usage Survey. Evidence to support face validity was gathered through a pilot test of the instrument (as described in Section 3.5.1.6 of Chapter 3).

As with the CCQ-P, care was taken during the development of scales and items in an attempt to ensure that the language would be familiar to primary school-aged students and that they would be able to comprehend the statements. In particular, it was important to simplify any technical language related to ICT to make the items meaningful and comprehensible for the students.

To further enhance the face validity of the survey, contextual cues were provided in the form of child-friendly names for the scales. For example, the scale relating to Managing and Operating ICT Effectively was referred to as Using ICT in the survey. The ICT Usage Survey scales and the modified scale names used for students are provided in Table 4.10.

Table 4.10. ICT Usage Survey scale names and corresponding contextual cues used in the survey presented to students

| ICT Usage Survey Scales | Contextual cue used in the student version of the ICT Usage Survey |
|---|--|
| Investigating with ICT | Finding Things Out Using ICT |
| Creating with ICT | Being Creative with ICT |
| Communicating with ICT | Using ICT to Communicate |
| Applying Social and Ethical Protocols and Practices | Doing the Right Thing |
| Managing and Operating ICT Effectively | Using ICT |
| Changing Trends | Changing Trends |

The results of the pilot study indicated that the term ICT was familiar to students. Students indicated that they understood this term to mean different technologies such as computers, iPads, laptops, and different programs and apps.

As with the CCQ-P, feedback from the pilot indicated that students found the use of stems difficult. Therefore, the sentence starter was included in every item within the scale, for example, *My teacher helps me to plan online searches.*

The results of the pilot study indicated that students were able to understand the items. On average, the survey took around 20 to 30 minutes to complete, which the students felt was an acceptable length of time. No technical issues were identified during the pilot study. Students were easily able to login to the online survey and navigate through the questionnaire. When students omitted a response, they were not able to move to the next page until this was rectified; the missing response was highlighted in red to assist them in this respect. A copy of the final ICT Usage Survey can be found in Appendix 4.

This section (Section 4.3.1) described the process used in the present study to gather evidence to support the translation validity of the ICT Usage Survey in terms of content validity (Section 4.3.1.1) and face validity (Section 4.3.1.2). The following section (Section 4.3.2) outlines the process used in this research to gather evidence to support criterion validity of the ICT Usage Survey.

4.3.2 Criterion Validity of the ICT Usage Survey

The following section outlines evidence related to the criterion validity of the ICT Usage Survey. This evidence is organised in terms of convergent validity (Section 4.3.2.1); discriminant validity (Section 4.3.2.2); concurrent validity (Section 4.3.2.3); and predictive validity (Section 4.3.2.4).

4.3.2.1 Convergent Validity

In order to provide evidence to support the convergent validity of the six scales within the ICT Usage Survey, data collected from the matched sample of 574 students in 31 classes were analysed. This section reports the results from the factor analysis and internal consistency reliability measures using data from students' actual responses.

Principal axis factoring with oblique rotation was used to check the structure of the six-scale ICT Usage Survey. The two criteria used for retaining any item were that the item must have a factor loading of at least .40 on its own scale and that it should have a loading of less than .40 on any of the other scales (Field, 2009; Stevens, 1992;

Thompson, 2004). The results of the factor analysis, reported in Table 4.11, supported a 29-item, five-scale structure for ICT Usage Survey.

One of the six scales (Creating with ICT) was omitted as it did not meet the criteria outlined above. For the remaining five scales, with the exception of two items, all items loaded on their own scale at .40 or above and below .40 on all other scales. The exceptions were items 31 and 33 within the Managing and Operating ICT Effectively scale; these two items did not load at .40 or above on their own or any other scale. However, these two items were retained as their omission was found to reduce the overall reliability of the scale.

The percentage of the total variance that was explained by each factor (reported at the bottom of Table 4.11), ranged from 4.11% to 37.69% for the different scales. The cumulative variance explained by all five factors was 64.35%. The eigenvalue for each factor was greater than 1, as recommended by Kaiser (1974); the eigenvalues ranged from 1.19 to 10.93 for the different scales.

Overall, the data provided strong support for the factorial validity of the five-scale ICT survey. Having established the factorial validity of the survey, the next step was to examine the internal consistency reliability of each of the five scales.

To examine whether the scale items assessed the same construct, the Cronbach's alpha coefficient was utilised as an index of internal consistency reliability. This coefficient was calculated for each ICT Usage Survey scale for two units of analysis (the individual and the class mean responses). Using the individual as the unit of analysis, the scale reliability estimates (reported in Table 4.12), ranged from .81 to .91. Using the class mean as the unit of analysis, the scale reliability estimates were higher, ranging from .88 to .97. According to Cohen, Manion, and Morrison's (2011) criteria, these alpha reliability estimates (at both levels of analysis) support the internal consistency of all five scales of the ICT Usage Survey.

Table 4.11. Factor loadings, eigenvalues, and percentages of variance explained for the actual version of the ICT Usage Survey

| Item | Factor Loadings | | | | |
|------------|------------------------|------------------------|---|-----------------|--|
| | Investigating with ICT | Communicating with ICT | Applying Social and Ethical Protocols and Practices | Changing Trends | Managing and Operating ICT Effectively |
| 1 | .84 | | | | |
| 2 | .85 | | | | |
| 3 | .85 | | | | |
| 4 | .78 | | | | |
| 5 | .79 | | | | |
| 6 | .78 | | | | |
| 14 | | .62 | | | |
| 15 | | .82 | | | |
| 16 | | .64 | | | |
| 17 | | .78 | | | |
| 18 | | .73 | | | |
| 19 | | .58 | | | |
| 20 | | .83 | | | |
| 21 | | .78 | | | |
| 22 | | | .54 | | |
| 23 | | | .90 | | |
| 24 | | | .92 | | |
| 25 | | | .85 | | |
| 26 | | | .73 | | |
| 27 | | | | .70 | |
| 28 | | | | .70 | |
| 29 | | | | .57 | |
| 30 | | | | .73 | |
| 31 | | | | | – |
| 32 | | | | | .49 |
| 33 | | | | | – |
| 34 | | | | | .71 |
| 35 | | | | | .79 |
| 36 | | | | | .83 |
| Eigenvalue | 2.93 | 10.93 | 2.21 | 1.19 | 1.40 |
| % variance | 10.11 | 37.69 | 7.63 | 4.11 | 4.81 |

Factor loadings smaller than .40 have been omitted.

N = 574 students in 31 classes.

Items 7 to 13 (in the Creating with ICT scale) are not shown as this scale was omitted due to poor factor validity.

Overall, the factor loadings and internal consistency results indicate that the items within each scale of the ICT Usage Survey were highly correlated with each other. As such, these results provide evidence to support the convergent validity of the survey.

Table 4.12. Internal consistency reliability (Cronbach's alpha coefficient) for the scales of the ICT Usage Survey

| Scale | Unit of analysis | Cronbach's alpha coefficient |
|---|------------------|------------------------------|
| Investigating with ICT | Individual | .91 |
| | Class Mean | .96 |
| Communicating with ICT | Individual | .90 |
| | Class Mean | .97 |
| Applying Social and Ethical Protocols and Practices | Individual | .87 |
| | Class Mean | .95 |
| Managing and Operating ICT Effectively | Individual | .86 |
| | Class Mean | .88 |
| Changing Trends | Individual | .81 |
| | Class Mean | .94 |

N = 574 students in 31 classes.

4.3.2.2 Discriminant Validity

According to Trochim and Donnelly (2008), discriminant validity is demonstrated when the correlations between any given item and the other items in the same construct are greater than the correlations between that item and the items from different constructs. In the case of the ICT Usage Survey, analysis of the correlation matrix from oblique rotation for the actual form of the survey (reported in Table 4.13) showed that the highest correlation between any two scales was .44, thus supporting the discriminant validity of the survey.

4.3.2.3 Concurrent Validity

To examine whether the ICT Usage Survey scales could differentiate between the perceptions of learners in different classes, an ANOVA was conducted for each scale. Class membership was used as the independent variable.

Table 4.13. Component correlation matrix for the scales of the actual version of the ICT Usage Survey

| Scale | Investigating with ICT | Communicating with ICT | Applying Social and Ethical Protocols and Practices | Managing and Operating ICT Effectively | Changing Trends |
|---|------------------------|------------------------|---|--|-----------------|
| Investigating with ICT | – | .34 | .40 | .37 | .39 |
| Communicating with ICT | .34 | – | .30 | .44 | .39 |
| Applying Social and Ethical Protocols and Practices | .40 | .30 | – | .37 | .38 |
| Managing and Operating ICT Effectively | .37 | .44 | .37 | – | .34 |
| Changing Trends | .39 | .39 | .38 | .34 | – |

N = 574 students in 31 classes.

The ANOVA results, reported in Table 4.14, indicate that the η^2 values ranged from .18 to .40 with all scales differentiating at statistically significant levels between classes ($p < .01$). Overall, the results suggested that students within the same class perceived the use of ICT in a relatively similar manner, whereas the perceptions of students in different classes varied.

Table 4.14. Ability to differentiate between classes (ANOVA results) for each scale of the ICT Usage Survey (based on responses to the actual version)

| Scale | ANOVA results (η^2) |
|---|----------------------------|
| Investigating with ICT | .18** |
| Communicating with ICT | .40** |
| Applying Social and Ethical Protocols and Practices | .24** |
| Managing and Operating ICT Effectively | .23** |
| Changing Trends | .22** |

N = 574 students in 31 classes.

* $p < .05$; ** $p < .01$.

4.3.2.4 Predictive Validity

Theoretically, students' self-reports of ICT usage should be related to their enjoyment of ICT. Therefore, to examine the predictive validity of the scales of the ICT Usage Survey, simple correlation analysis was used. The results, reported in Table 4.15, indicate that all five scales were statistically significantly ($p < .01$) correlated with students' enjoyment of using ICT, supporting the predictive validity of the ICT Usage Survey.

Table 4.15. Pearson correlations between Enjoyment of ICT and the scales of the ICT Usage Survey

| ICT Usage Survey Scale | Pearson correlation (two-tailed) |
|---|----------------------------------|
| Investigating with ICT | .32** |
| Communicating with ICT | .25** |
| Applying Social and Ethical Protocols and Practices | .27** |
| Managing and Operating ICT Effectively | .32** |
| Changing Trends | .44** |

$N = 574$ students in 31 classes.

** $p < .01$.

The results of both the translation and criterion validity measures (as suggested by Trochim & Donnelly, 2008), provided strong support for the use of the 29-item, five-scale ICT Usage Survey with primary school students to assess their perceptions of their ICT use within the classroom.

This section (Section 4.3) has reported the evidence used to support translation and criterion validity of the ICT Usage Survey. The results of both the translation (Section 4.3.1) and criterion validity measures (Section 4.3.2), as suggested by Trochim and Donnelly (2008), provided strong support for the use of the 29-item, five-scale ICT Usage Survey with primary school students to assess their ICT use within the classroom. The following section (Section 4.4) reports the evidence used to support the validation of the SEEQ.

4.4 Validation of the Self-Efficacy and Enjoyment Questionnaire (SEEQ)

As described in Section 3.5 of Chapter 3, the Self-Efficacy and Enjoyment Questionnaire (SEEQ) was developed to provide teachers in primary school classrooms with information about students' self-efficacy and their enjoyment of both their class and the use of ICT (research objective 1). The use of the SEEQ in this study allowed for an examination of the ways that both students' perceptions of their learning environment and students' use of ICT were related to their self-efficacy, enjoyment of class, and enjoyment of using ICT (research objectives 3 and 4).

The SEEQ sought to assess student outcomes that were expected to be important determinants of student achievement, namely, self-efficacy and enjoyment. The review of literature (summarised in Section 2.4 of Chapter 2) revealed that no existing instruments were suitable for use in the present study. However, the development of the SEEQ drew on the existing ASBS, developed by Bell and Aldridge (2014), which had been validated for use at the secondary school level in Western Australia. The ASBS included two scales, namely, Attitude to Subject and Academic Efficacy. The Self-Efficacy scale in the SEEQ was adapted from the ASBS Academic Efficacy scale, and the Enjoyment of Class scale in the SEEQ was adapted from the ASBS Attitude to Subject scale. The third scale of the SEEQ, Enjoyment of ICT, was developed for the purpose of this study.

This section reports evidence to support the reliability and validity of the SEEQ. As was done for the CCQ-P and the ICT Usage Survey, this evidence is organised in relation to translation validity (Section 4.4.1) and criterion validity (Section 4.4.2).

4.4.1 Translation Validity of the SEEQ

This section outlines the translation validity of the SEEQ. Translation validity is examined in terms of both content validity (Section 4.4.1.1) and face validity (Section 4.4.1.2).

4.4.1.1 Content Validity

The first step in ensuring the content validity of the SEEQ, a review of literature (summarised in Section 2.4 of Chapter 2) was conducted to identify student affective outcomes that were important to the present study. Three affective outcomes (self-efficacy, enjoyment of class, and enjoyment of ICT) were selected, and literature related to these three outcomes was reviewed. During this review it was established that no existing instruments were suitable for use in the present study. However, the Academic Efficacy and Attitude to Subject scales in the ASBS (Bell & Aldridge, 2014) were selected as suitable for modification for use with primary school students.

The second step involved the development of the SEEQ scales. All three scales of the SEEQ (Self-Efficacy, Enjoyment of Class, and Enjoyment of ICT) contained five items, providing 15 items in total. The Self-Efficacy scale was referred to as Self-Belief in the student version of the survey to provide contextual cues that were relevant to primary aged students. A description and a sample item for each SEEQ scale are provided below in Table 4.16. The subsequent text describes each scale in more detail along with a justification for its inclusion in the new instrument.

Table 4.16. Description and sample item for each scale of the SEEQ

| SEEQ scale | Description | Sample item |
|---|---|---|
| Self-Efficacy (<i>Self-Belief</i>) | <i>The extent to which ...</i> ... students are confident and believe in his/her own ability to successfully perform learning tasks. | I am good at my work. |
| Enjoyment of Class | ... students find their class to be enjoyable and fun. | This class makes me want to come to school. |
| Enjoyment of ICT | ... students enjoy using ICT. | Lessons that use ICT are fun. |

The *Self-Efficacy* scale was intended to assess the extent to which students believe they can achieve competence in their learning. Self-efficacy refers to a person's belief

in their own capabilities and stems from Bandura's (1977) social cognitive theory. According to social cognitive theory, a person's self-efficacy can impact on their interest, motivation, and attitude towards learning (Bassi et al., 2007). Past research has suggested a strong relationship between student self-efficacy and learning related effort and persistence (Bandura, 1977; Jinks & Morgan, 1999; Schunk & Zimmerman, 2013; Zimmerman, 1995; Zimmerman & Bandura, 1994). Research has also indicated a correlation between self-efficacy and student academic achievement (Bandura, 1989; Boz et al., 2016; Jinks & Morgan, 1999; Multon, Brown, & Lent, 1991; Schunk, 1989). Velayutham et al. (2011) suggested that sources of students' self-efficacy could include the psychosocial learning environment and that students' opinions of their own abilities (that is, their self-efficacy) could have important implications for enhancing the classroom environment and, ultimately, student academic outcomes. Given the importance of self-efficacy to a range of student outcomes, a self-efficacy scale was developed for use in the SEEQ.

The Self-Efficacy scale of the SEEQ drew on the Academic Efficacy scale from the ASBS (Bell & Aldridge, 2014). The new scale was used to investigate the associations between students' perceptions of their learning environment, their use of ICT in the classroom and their self-reports of self-efficacy. According to Bandura (2006), no all-purpose measure of self-efficacy exists, and efficacy scales must, therefore, be tailored to suit specific domains or contexts such as a learning area. As such, to ensure that the new Self-Efficacy scale was suitable for use with primary school students, the Academic Efficacy scale from the ASBS was modified in two ways. First, the number of items was reduced from seven to five; second, the wording of the items was refined and simplified in an effort to improve their readability and meaning for primary school-aged students. In accordance with this recommendation, the Self-Efficacy scale in the SEEQ was specifically developed to measure primary school students' academic efficacy within their classroom context. Bandura (2006) emphasises that survey scales should accurately reflect the construct that they are intended to measure and should be phrased using the terminology of *can do* (a judgement of capability) rather than *will do* (a statement of intention); this advice was adhered to in the development of each item.

The *Enjoyment of Class* scale was intended to assess the extent to which students enjoy the classroom in which their learning occurs. According to Ryan and Deci (2000), when students find their learning environment to be enjoyable, they are more likely to be engaged in learning and intrinsically motivated to learn. Research suggests that enjoyment provides motivation to participate in an activity (Warner, 1980). Enjoyment is also vital to learning (Lumby, 2012) and is positively related to student performance (Ainley & Ainley, 2011; Ashby et al., 1999; Blunsdon et al., 2003; Boekaerts, 2010; Cattell, 1961; Eccles, 1983; Frenzel et al., 2009; Gomez et al., 2010; Pekrun & Stephens, 2011; Pekrun et al., 2002). Given the importance of enjoyment for a range of student outcomes, an Enjoyment of Class scale was developed for use in the SEEQ.

The Enjoyment of Class scale drew on the Attitude to Subject scale from the ASBS (Bell & Aldridge, 2014) and was used to investigate the associations between students' perceptions of their learning environment, their use of ICT, and their self-reports of the level of enjoyment that they experience within their classroom. To ensure that the Enjoyment of Class scale was suitable for use with primary school-aged students, the Attitude to Subject scale from the ASBS was modified. First, given that primary school students in the Australian context are taught most subjects by one teacher within the same classroom environment, this scale was renamed Enjoyment of Class rather than focusing on the enjoyment of a particular subject area. Second, the number of items was reduced from seven to five. Finally, the wording of the items was refined and simplified in an effort to improve their readability and meaning for primary school-aged students.

The *Enjoyment of ICT* scale was intended to assess the extent to which students enjoy the use of ICT within their learning environment. Past research has suggested that the use of ICT can improve students' learning experiences by facilitating the delivery and management of classroom instruction (Gomez et al., 2010). The effective integration of ICT in the classroom has the potential to enhance student enjoyment and engagement by allowing students to be active learners (Gomez et al., 2010; Wu et al., 2009). Learning environments can be enhanced by the incorporation of technology as ICT use can be perceived as intrinsically motivating and enjoyable in its own right (Deci & Ryan, 2000; Lee et al., 2015; Maiano et al., 2011; Venkatesh et al., 2003;

Zaman et al., 2010). Given the impact that ICT can have on student outcomes, an Enjoyment of ICT scale was developed for inclusion in the SEEQ.

To ensure consistency within this study, students responded to the SEEQ items using the same five-point response format that was used for the CCQ-P and ICT Usage Survey: *almost never, rarely, sometimes, often, and almost always*. The validity of this five-point frequency scale was examined through a pilot study, the results of which are reported in Section 4.2.1.2.

In addition to this literature review which provided a strong theoretical foundation, the content validity was further addressed through the input of the same expert review panel that was used with the CCQ-P and ICT Usage Survey. The panel members reviewed the draft scales and items for the SEEQ to ensure that the items were relevant to and adequately covered the construct that each scale was intended to assess. The expert panel scrutinised the scales and items of the SEEQ and confirmed that, in their opinion, the items provided good coverage of the construct that they were intended to assess.

4.4.1.2 Face Validity

As with the CCQ-P and the ICT Usage Survey, care was taken during the development of the scales and items of the SEEQ in an effort to ensure that the language would be familiar to primary school-aged students and that they would be able to comprehend the items. The face validity of the SEEQ was examined through the use of an expert review panel and a pilot study. This process was identical to the process outlined in Section 4.2.1.2 for the CCQ-P and used the same expert panel consisting of eight experienced primary educators,

The expert panel scrutinised the scales and items of the SEEQ in terms of their readability for primary school aged students. The panel made suggestions with respect to the simplification of the language of one item in the Self-Efficacy scale. This item originally read *I can understand teacher instructions*; however, the panel recommended simplifying it to *I can understand what the teacher tells me*. The panel felt that the proposed 15-item, three-scale survey was suitable for primary school

students and confirmed that the term Self-Belief would be likely to be better understood by students of this age than the term Self-Efficacy.

As with the CCQ-P and ICT Usage Survey, the same group of 30 year 4 students participated in a pilot study to examine whether individual items were comprehended in ways that were intended by the researcher; the usability of the response format; and any technical issues related to the administration of the questionnaire. During the student interviews, students indicated that, in general, they found the items of the SEEQ easy to understand. To examine whether individual items were comprehended in ways that were intended by the researcher, students were questioned about the meaning of individual items. The results suggested that the students had an adequate understanding of each item. For example, when asked about the meaning of the item *I have a good time in this class*, one student described the item as meaning “I have fun in the classroom.” When questioned about the item *I am good at my work*, one student responded that it meant “I get things right.” When asked about the item *I enjoy lessons that use ICT*, one student responded that this meant “I like lessons when we get to use computers or iPads.”

During the pilot study, the six students were also questioned to ensure they understood the overall constructs to which the survey items related. The results of the interviews indicated that the students understood what each item meant. For example, one student described self-belief as “Believing in myself” and another described it as “Knowing I can do it”. Students also indicated that they understood that the Enjoyment of Class scale referred only to their main classroom; for example, one student reported answering the questions in this scale in relation to only the time spent with their classroom teacher and not any specialist teachers such as sports or music teachers.

The usability of the response format was addressed through the CCQ-P pilot study, the results of which are described in Section 4.2.1.2. The SEEQ took students no more than five minutes to complete and students felt that it was a fast survey to respond to.

This section (Section 4.4.1) described the process used in the present study to gather evidence to support the translation validity of SEEQ in terms of content validity (Section 4.4.1.1) and face validity (Section 4.4.1.2). The following section (Section

4.4.2) outlines the process used in this research to gather evidence to support criterion validity of the SEEQ.

4.4.2 Criterion Validity of the SEEQ

This section reports results related to the criterion validity of the SEEQ. The Self-Efficacy and Enjoyment of Class scales of the SEEQ were administered at the same time as the CCQ-P survey and the criterion validity of the SEEQ was examined using the matched sample of 574 students in 31 classes. The evidence in this section is organised in relation to convergent validity (Section 4.4.2.1), discriminant validity (Section 4.4.2.2), and concurrent validity (Section 4.4.2.3).

4.4.2.1 Convergent Validity

In order to confirm the convergent validity of the three scales within the SEEQ, the data was analysed using factor and item analyses and a measure of internal consistency reliability. This section reports the findings from these convergent validity measures.

Principal axis factoring with oblique rotation was used to check the structure of the three-scale SEEQ. The two criteria used for retaining any item were that the item must have a factor loading of at least .40 on its own scale and that it should have a loading of less than .40 on any of the other scales (Field, 2009; Thompson, 2004; Stevens, 1992). The results of the factor analysis, reported in Table 4.17, supported the proposed 15-item three-scale structure for the SEEQ. For all of the three scales of the SEEQ, the items, without exception, loaded on their a priori scales at .40 or above (the lowest being .69) and loaded at less than .40 on all other scales.

The percentage of variance that was extracted with each factor was 11.97% for the Self-Efficacy scale, 38.93% for the Enjoyment of Class scale, and 17.81% for the Enjoyment of ICT scale. The cumulative variance across all factors was 68.71%. The eigenvalue for each factor was greater than 1, as recommended by Kaiser (1974); the eigenvalues ranged from 1.80 to 5.84 for the different scales.

The Cronbach alpha coefficient was used to examine the internal consistency reliability of the scales of the SEEQ; these coefficients are reported in Table 4.18.

With the individual used as the unit of analysis, the alpha coefficients ranged between .82 and .92 for the different scales; with the class mean used as the unit of analysis, the alpha coefficients ranged from .84 to .97 for the different scales. According to Cohen, Manion, and Morrison's (2011) minimum criteria of .80, these alpha reliability estimates were acceptable; therefore, the internal consistency of each of the scales of the SEEQ was supported.

Table 4.17. Factor loadings, eigenvalues, and percentages of variance explained for the scales of the SEEQ

| Item | Factor Loadings | | |
|------------|-----------------|--------------------|------------------|
| | Self-Efficacy | Enjoyment of Class | Enjoyment of ICT |
| 1 | | .87 | |
| 2 | | .88 | |
| 3 | | .90 | |
| 4 | | .89 | |
| 5 | | .83 | |
| 6 | .80 | | |
| 7 | .77 | | |
| 8 | .79 | | |
| 9 | .69 | | |
| 10 | .76 | | |
| 11 | | | .92 |
| 12 | | | .89 |
| 13 | | | .93 |
| 14 | | | .77 |
| 15 | | | .87 |
| Eigenvalue | 1.80 | 5.84 | 2.67 |
| % Variance | 11.97 | 38.93 | 17.81 |

Factor loadings smaller than .40 have been omitted.
N = 574 students in 31 classes.

Overall, the factor loadings and internal consistency results confirmed the convergent validity of the survey. The scales and items within the SEEQ were found to be highly correlated with each other.

Table 4.18. Internal consistency reliability (Cronbach's alpha coefficient) for the scales of the SEEQ.

| Scale | Unit of analysis | Cronbach's alpha coefficient |
|--------------------|------------------|------------------------------|
| Self-Efficacy | Individual | .82 |
| | Class Mean | .84 |
| Enjoyment of Class | Individual | .92 |
| | Class Mean | .97 |
| Enjoyment of ICT | Individual | .86 |
| | Class Mean | .87 |

N = 574 students in 31 classes.

4.4.2.2 Discriminant Validity

Discriminant validity is demonstrated when the correlations between any given item and the other items in the same construct are greater than the correlations between that item and the items from different constructs (Trochim & Donnelly, 2008). In the case of the SEEQ, analysis of the intercorrelation matrix from the oblique rotation, reported in Table 4.19, demonstrated that this condition was achieved. Analysis of the correlation matrix, showed that the highest correlation between any two scales was .43, supporting the discriminant validity of the SEEQ.

Table 4.19. Component correlation matrix for the scales of the SEEQ

| Scale | Self-Efficacy | Enjoyment of Class | Enjoyment of ICT |
|--------------------|---------------|--------------------|------------------|
| Self-Efficacy | – | .34 | .23 |
| Enjoyment of Class | .34 | – | .43 |
| Enjoyment of ICT | .23 | .43 | – |

N = 574 students in 31 classes.

4.4.2.3 Concurrent Validity

To examine whether the actual form of each scale of the SEEQ could differentiate between the perceptions of students in different classes, ANOVA was calculated for each scale. Class membership was used as the independent variable. The results (reported in Table 4.20) indicated that whereas the Enjoyment of Class and Enjoyment of ICT scales differentiated between classes at statistically significant levels ($p < .01$), the Self-Efficacy scale did not. Overall, the results provided evidence to suggest concurrent validity of the SEEQ scales.

Table 4.20. Ability to differentiate between classes (ANOVA results) for each scale of the SEEQ

| Scale | ANOVA results |
|--------------------|---------------|
| Self-Efficacy | .07 |
| Enjoyment of Class | .15** |
| Enjoyment of ICT | .10** |

N = 574 students in 31 classes.

* $p < .05$; ** $p < .01$.

This section (Section 4.4) has outlined the process used in the present study to gather evidence to support translation and criterion validity of the SEEQ. The results of both the translation (Section 4.4.1) and criterion validity measures (Section 4.4.2), as suggested by Trochim and Donnelly (2008), provided strong support for the use of the 15-item, three-scale SEEQ with primary school students to assess their self-reports of self-efficacy, enjoyment of class, and enjoyment of using ICT within the learning environment. The following section (Section 4.5) concludes Chapter 4 by providing a chapter summary.

4.5 Chapter Summary

The development of three new surveys that could be used at the primary school level was integral to this study. These surveys were the Classroom Climate Questionnaire—Primary (CCQ-P); the ICT Usage Survey; and the Self-Efficacy and Engagement Questionnaire (SEEQ). It was important to provide evidence to support the reliability and validity of each of these three instruments to establish confidence in the results that followed. Such evidence was established using Trochim and Donnelly’s (2008) construct validity framework, ensuring that the criteria for both translation and criterion validity were fulfilled. As outlined by Trochim and Donnelly (2008), and described in Section 3.6.1.1 of Chapter 3, translation validity is comprised of content and face validity; criterion validity is comprised of convergent, discriminant, concurrent, and predictive validity.

To support the content validity of each of the three surveys (as described in Section 4.2.1.1), a review of relevant literature was conducted, as a first step, to identify important constructs related to the learning environment, integration of ICT, and related student affective outcomes as well as to review existing instruments to determine their suitability for the present study. This literature review is outlined in Chapter 2. The COLES, designed by Aldridge, Fraser, et al. (2012), was identified as an instrument that was both applicable to the present study and a reliable tool to assess secondary students’ perceptions of the learning environment. As a result, seven scales were drawn from the COLES to inform the development of the CCQ-P: Student Cohesiveness, Teacher Support, Equity, Involvement, Task Orientation, Personal Relevance, and Collaboration. Two further scales, Task Clarity and Responsibility for Learning, were developed for the purpose of this study. Given that the COLES was designed for use with secondary school students, the scale names and wording within the survey were simplified for use with primary school students. The number of items was also reduced to five in each of the nine scales, providing 45 items in total.

As no suitable instrument was available to assess the integration of ICT in the primary classroom context, the scales comprising the ICT Usage Survey were developed based on the ICT general capability from the Australian Curriculum (ACARA, n.d.). The items and scales within the ICT Usage Survey were designed to assess the degree to

which teachers incorporate the organising elements of this general capability into their classroom instruction. The six scales were Investigating with ICT (six items), Creating with ICT (seven items), Communicating with ICT (eight items), Applying Social and Ethical Protocols and Practices (five items), Managing and Operating ICT Effectively (six items), and Changing Trends (four items). In total, the ICT Usage Survey was comprised of 36 items within six scales.

The Attitudes and Self-Belief Survey (ASBS), originally developed and validated for use by Bell and Aldridge (2014) at the secondary school level, was identified as a valid and reliable tool for assessing self-efficacy and enjoyment. As such, two of the SEEQ scales were adapted from the ASBS (namely, the Self-Efficacy and Enjoyment of Class scales). A third scale, the Enjoyment of ICT scale, was developed for the purpose of this study. All three scales of the SEEQ contained five items, providing 15 items in total.

The content validity of the three surveys was further addressed through the input of an expert review panel. The panel, consisting of eight experienced primary educators, reviewed the draft scales and items as well as the response format. The panel assessed and confirmed the content validity of the scales of all three instruments, indicating that, in their view, the items were relevant to and adequately covered the construct that each scale was intended to measure.

In addition to addressing content validity, the expert panel members scrutinised the scales and items of each survey in terms of their readability for primary age students and whether the items provided good coverage of the scale. As a result of this review, the language used within several scales was simplified.

To examine the face validity of the three newly-developed surveys (as described in Section 4.2.1.2), a pilot study involving 30 year 4 students (representative of the youngest participants in this study) was conducted. The pilot study was used to examine whether the individual items were comprehended in ways that were intended by the researcher; the usability of the response format; and any technical issues related to the administration of the questionnaire. As a result of the pilot study, the term *seldom* in the response format was simplified to *rarely*, thereby altering the response

format for all three surveys to a five-point frequency scale of: *almost never, rarely, sometimes, often, and almost always*. As a result of feedback from both the expert panel and the pilot study, some items were omitted to shorten the surveys to better suit the primary school-aged respondents. To further support the face validity of the surveys, the scale names on the online surveys were simplified to provide contextual cues that would be more relevant to primary aged students.

To examine the criterion validity of the surveys, the sample of 574 students was analysed to provide evidence to support the convergent validity of the scales within each of the three surveys. The data was analysed to examine the factor structure, internal consistency reliability, discriminant validity, ability to differentiate between classes, and predictive validity.

To provide evidence to support the convergent validity of the CCQ-P (as described in Section 4.2.2.1), principal axis factoring with oblique rotation was used to check the structure of the CCQ-P. For both the actual and preferred versions of the questionnaire, the factor loadings for students' responses indicated that all of the items loaded at above .40 on their respective factors and did not load at .40 or above on any other factor, with one exception: Item four of the actual version which loaded on its own scale at .58 as well as on the Teacher Support scale at .55. Further analyses indicated that the reliability estimates for this scale would have been reduced by the omission of Item 4, therefore the item was retained. The Cronbach's alpha coefficient, used as an index of the internal consistency reliability, were high (the lowest alpha coefficient being .78) for both the actual and preferred versions of the questionnaire. To provide evidence to support the discriminant validity of the CCQ-P (as described in Section 4.2.2.2), analysis of the component correlation matrix obtained from oblique rotation demonstrated that the highest correlation between any two scales was .58 for the actual version and .47 for the preferred version.

To provide evidence to support concurrent validity (as described in Section 4.2.2.3), ANOVA results indicated that the η^2 values varied between .06 and .11 for the different CCQ-P scales. All of the scales, with exception of two (Student Cohesiveness and Equity), were able to differentiate satisfactorily between classes ($p < .05$). Overall, the results supported the concurrent validity of the CCQ-P. To provide

evidence to support predictive validity (as described in Section 4.2.2.4), the simple correlation results indicated that all nine scales of the CCQ-P were statistically significantly ($p < .01$) correlated with student self-efficacy, thus supporting the predictive validity of the CCQ-P.

Data from the sample of 574 students were also analysed to support the validity of the six-scale ICT Usage Survey (as described in Section 4.3.2.1). The factor analysis resulted in the omission of one scale (Creating with ICT) as it did not meet the criteria. The factor loadings for the items of the remaining five scales indicated that, with the exception of two items (items 31 and 33 within the Managing and Operating ICT Effectively scale), all items loaded on their own scale at .40 or above and at below .40 on all other scales. The two items were retained as they added to the overall reliability of the scale. The internal consistency reliability measures for each ICT Usage Survey scale were high with the lowest coefficient being .81. Overall, the data provided strong support for the convergent validity of the 29-item, five-scale ICT Usage Survey.

To provide evidence to support the discriminant validity of the ICT Usage Survey (as described in Section 4.3.2.2), analysis of the correlation matrix from oblique rotation for the actual form of the survey showed that the highest correlation between any two scales was .44. To provide evidence to support concurrent validity (as described in Section 4.3.2.3), ANOVA results indicated that the η^2 values varied between .18 to .40 with all scales differentiating at statistically significant levels between classes ($p < .01$). To provide evidence to support predictive validity (as described in Section 4.3.2.4), the simple correlation results indicated that all five scales were statistically significantly ($p < .01$) correlated with students' enjoyment of using ICT, thus supporting the predictive validity of the ICT Usage Survey.

Principal axis factoring with oblique rotation was used to check the structure of the SEEQ (as described in Section 4.4.2.1). The factor loadings indicated that the items of the three SEEQ scales, without exception, loaded at .40 or above on their own scales and at less than .40 on all other factors. Internal consistency reliability measures for each SEEQ scale were high with the lowest coefficient being .82. According to Cohen, Manion, and Morrison's (2011) minimum criteria of .80, these alpha reliability estimates were acceptable; therefore, the internal consistency of each of the scales of

the SEEQ was supported. Overall, the data provided strong support for the convergent validity of the 15-item, three-scale SEEQ.

To provide evidence to support the discriminant validity of the SEEQ (as described in Section 4.4.2.2), analysis of the correlation matrix from oblique rotation showed that the highest correlation between any two scales was .43. To provide evidence to support concurrent validity (as described in Section 4.4.2.3), ANOVA results indicated that whereas the Enjoyment of Class and Enjoyment of ICT scales differentiated between classes at statistically significant levels ($p < .01$), the Self-Efficacy scale did not. Overall, the results provided evidence to suggest concurrent validity of the SEEQ scales.

Overall, the results presented in this chapter provide evidence to support the CCQ-P, the ICT Usage Survey and the SEEQ as valid instruments for the purposes of this research (research objective 1). The validity of the surveys give confidence regarding the use of these instruments in future studies. The next chapter reports results related to research objectives 2 to 6 based on the data collected from student responses during the large-scale implementation of each survey.

**ANALYSIS AND RESULTS:
DETERMINANTS AND EFFECTS**

5.1 Introduction

Whereas the previous chapter reported the evidence used to support the reliability and validity of the three surveys that were adapted and developed for the purposes of this study (thereby addressing research objective 1), this chapter reports results related to the remaining research objectives. The data collected using the three surveys from the sample of 574 students in 31 classes across 12 schools (as outlined in Section 3.4 of Chapter 3) were used to address the remaining five research objectives. The results in this chapter are reported under the following major headings:

- Differences between actual and preferred learning environment perceptions (research objective 2; Section 5.2);
- Associations between the learning environment and student outcomes (research objective 3; Section 5.3);
- Associations between the use of ICT and student outcomes (research objective 4; Section 5.4);
- Gender differences (research objective 5; Section 5.5); and
- Differences between the perceptions of at-risk and not at-risk students (research objective 6; Section 5.6).

5.2 Differences between Actual and Preferred Learning Environment Perceptions

The second research objective of the present study was to examine whether differences existed between what primary school aged students perceived that they actually experienced and what they would prefer, in terms of both their classroom learning environments and their use of ICT. To examine differences between the students' actual and preferred responses, descriptive statistics (including the average item means and average item standard deviations) were calculated. To examine whether the

actual–preferred differences were statistically significant, MANOVA was used. The students’ actual and preferred responses were used as the dependent variables; the nine learning environment scales and two of the ICT Usage Survey scales (Investigating with ICT and Communicating with ICT)¹⁰ were used as the independent variables. Finally, to examine the magnitude of the differences for students’ responses to the actual and preferred versions of each survey, the effect sizes were calculated. This section reports the results of these analyses in terms of students’ perceptions of the learning environment (Section 5.2.1) and of their ICT usage (Section 5.2.2).

5.2.1 Actual and Preferred Differences in Students’ Perceptions of their Learning Environment

The results, reported in Table 5.1 and displayed graphically in Figure 5.1, indicated that the average item means were higher for students’ preferred responses than for the corresponding actual responses for all CCQ-P scales¹¹ except Task Orientation. These results suggested that, with the exception of Task Orientation, students would prefer their learning environment to be more positive than they currently perceive the environment to be. As shown in Table 5.1, the average item standard deviations for the actual and preferred scores for all scales were less than 1, indicating a narrow spread across the student responses.

As described in Section 3.6.2, to determine whether there were statistically significant differences between students’ perceptions of their actual and preferred learning environments, a one-way MANOVA was used. Given that this multivariate test yielded significant results ($p < .01$) in terms of Wilks’s lambda criterion (Wilks, 1935; indicating that there were statistically significant differences in the set of criterion variables as a whole), the univariate ANOVA was interpreted for the individual CCQ-P scales. The ANOVA results (F values), reported in Table 5.1, indicated that there were statistically significant ($p < .01$) differences between the actual and preferred responses for all nine CCQ-P scales. For all but one scale, Task Orientation, the results suggested that students would prefer a more positive learning environment than they

¹⁰ The Investigating with ICT and Communicating with ICT scales were the only ICT Usage Survey scales used as dependent variables as these were the only two of the five ICT Usage Survey scales which utilised an actual–preferred format.

¹¹ Further description of the CCQ-P scales can be found in Section 4.2.1.1.

currently perceive to be present; however, the results indicated that students would prefer a lower level of Task Orientation than that which their current learning environment reflects.

Table 5.1. Average item means, average item standard deviations, and differences between means (effect sizes and MANOVA results) for the actual and preferred responses to the CCQ-P

| CCQ-P scale | Average item mean | | Average item standard deviation | | Difference between means | |
|-----------------------------|-------------------|-----------|---------------------------------|-----------|--------------------------|----------|
| | Actual | Preferred | Actual | Preferred | Effect size | <i>F</i> |
| Student Cohesiveness | 4.22 | 4.59 | 0.64 | 0.56 | 0.62 | 16.19** |
| Teacher Support | 3.95 | 4.31 | 0.83 | 0.74 | 0.45 | 12.17** |
| Equity | 3.89 | 4.41 | 0.88 | 0.72 | 0.65 | 15.34** |
| Task Clarity | 4.25 | 4.67 | 0.70 | 0.59 | 0.65 | 16.68** |
| Responsibility for Learning | 4.01 | 4.24 | 0.74 | 0.71 | 0.32 | 8.62** |
| Involvement | 3.49 | 4.02 | 0.90 | 0.88 | 0.60 | 16.37** |
| Task Orientation | 4.41 | 4.28 | 0.63 | 0.84 | 0.35 | 12.05** |
| Personal Relevance | 3.83 | 4.63 | 0.94 | 0.63 | 0.50 | 14.32** |
| Collaboration | 3.80 | 4.23 | 0.79 | 0.78 | 0.56 | 13.78** |

N = 574 students in 31 classes.

***p* < .01.

The effect size is the difference in means expressed in standard deviation units and was calculated using the formula: $d = M_1 - M_2 / \sqrt{[(\sigma_1^2 + \sigma_2^2) / 2]}$.

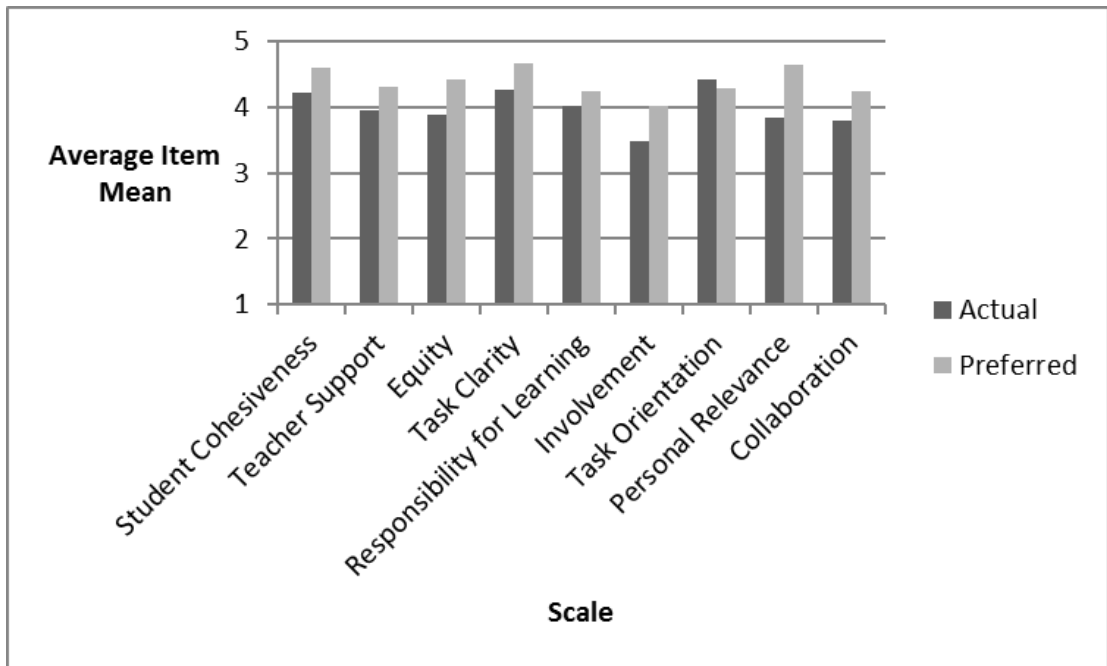


Figure 5.1. Average item means for the actual and preferred responses to the CCQ-P

To examine the magnitude of the differences between the actual and preferred means, the corresponding effect sizes (calculated as the difference in means divided by the pooled standard deviation) were calculated for each scale as recommended by Thompson (2001). With the exception of two scales (Responsibility for Learning and Task Orientation), the effect sizes were all greater than 0.40, ranging between nearly half a standard deviation (effect size of 0.45 for Teacher Support) and two-thirds of a standard deviation (effect size of 0.65 for Equity and Task Clarity). According to Cohen's (2013) criteria, these effect sizes can be considered to be medium in magnitude, indicating that the results were of practical significance. The two exceptions, Responsibility for Learning and Task Orientation, had effect sizes of 0.32 and 0.35, respectively. These effect sizes, according to Cohen's (2013) criteria, are considered to be small.

5.2.2 *Actual and Preferred Differences in Students' Perceptions of their ICT Use*

Two of the five scales of the ICT Usage Survey¹² involved both actual and preferred response formats (the Investigating with ICT and Communicating with ICT scales). The average item means, reported in Table 5.2, indicated that, for both of these scales, students' preferred responses were higher than their actual responses. These results suggested that students would prefer more frequent opportunities to investigate and communicate using ICT than they currently perceived to be present in the classroom.

A one-way MANOVA was used to determine whether there were statistically significant differences between students' actual and preferred responses for these two scales. The multivariate test yielded significant results ($p < .01$) in terms of Wilks's lambda criterion (Wilks, 1935), and, therefore, the univariate ANOVA was interpreted for each scale. The results, reported in Table 5.2, indicated that there were statistically significant ($p < .01$) actual–preferred differences for both ICT Usage Survey scales.

The effect sizes were calculated to examine the magnitude of the actual–preferred mean score differences. The results, reported in Table 5.2, indicated that the effect sizes were greater than 0.40 standard deviations for both the Investigating with ICT scale (effect size = 0.53 standard deviations) and Communicating with ICT (effect size = 0.70 standard deviations). According to Cohen's (2013) criteria, these effect sizes are moderate in magnitude, indicating that the results were of practical significance.

This section (Section 5.2) has summarised the results related to students' actual–preferred perceptual differences in relation to both the learning environment and their use of ICT in the classroom (research objective 2). When examining student perceptions of both their learning environment and their use of ICT, the results suggested that (with the exception of task orientation), students would prefer a more positive learning environment and greater opportunities to use ICT than they currently perceive to be present. The following section (Section 5.3) examines the results of the present survey related to research objective 3.

¹² Further description of the ICT Usage Survey scales can be found in Section 4.3.1.1.

Table 5.2. Average item means, average item standard deviations, and differences between means (effect size and MANOVA results) for the actual and preferred responses to the ICT Usage Survey

| ICT Usage Survey scale | Average item mean | | Average item standard deviation | | Difference between means | |
|------------------------|-------------------|-----------|---------------------------------|-----------|--------------------------|----------|
| | Actual | Preferred | Actual | Preferred | Effect Size | <i>F</i> |
| Investigating with ICT | 3.25 | 3.76 | 0.95 | 0.99 | 0.53 | 13.09** |
| Communicating with ICT | 2.40 | 3.18 | 1.02 | 1.19 | 0.70 | 15.77** |

N = 574 students in 31 classes.

***p* < .01; **p* < .05.

The effect size is the difference in means expressed in standard deviation units and was calculated using the formula: $d = M_1 - M_2 / \sqrt{[(\sigma_1^2 + \sigma_2^2) / 2]}$.

5.3 Associations between the Learning Environment and Student Outcomes

The third research objective for the present study sought to examine the relationships between students' perceptions of their learning environment and their self-reports of self-efficacy and enjoyment (of both their class and their use of ICT). Data analyses in relation to this objective were conducted using the actual responses only from the sample of 574 students. Simple correlation analysis was used to examine the bivariate relationships between the CCQ-P and SEEQ scales, using the individual students as the unit of analysis. Multiple regression analysis (*R*) was then used to provide a more parsimonious picture of the joint influence of the correlated learning environment scales (from the CCQ-P) on self-efficacy, enjoyment of class, and enjoyment of using ICT (measured using the SEEQ); incorporating this analysis was also intended to reduce the Type I error rate.

The three SEEQ scales were used as the independent variables and the CCQ-P scales were used as the dependent variables of the simple correlation and multiple regression analyses. To identify which of the learning environment scales contributed uniquely and significantly explaining the variance in the student outcomes, the standardised regression coefficients (β) were examined.

The results of the simple correlation and multiple regression analyses are reported in this section in terms of students' self-efficacy (Section 5.3.1); enjoyment of class (Section 5.3.2); and enjoyment of using ICT (Section 5.3.3). Table 5.3 provides a summary of these results.

Table 5.3. Simple correlation and multiple regression results for associations between the CCQ-P and SEEQ scales

| CCQ-P Scales | SEEQ Scales | | | | | |
|----------------------------------|---------------|---------|--------------------|---------|------------------|---------|
| | Self-Efficacy | | Enjoyment of Class | | Enjoyment of ICT | |
| | <i>r</i> | β | <i>r</i> | β | <i>r</i> | β |
| Student Cohesiveness | .44** | 0.10** | .39 | 0.07 | .14** | -0.07 |
| Teacher Support | .25** | -0.11* | .54** | 0.18** | .24** | 0.03 |
| Equity | .35** | -0.10* | .52** | 0.07 | .22** | -0.05 |
| Task Clarity | .59** | 0.34** | .46** | 0.09 | .30** | 0.11 |
| Responsibility for Learning | .42** | 0.00 | .38** | 0.01 | .19** | -0.03 |
| Involvement | .51** | 0.29** | .52** | 0.07 | .24** | 0.02 |
| Task Orientation | .56** | 0.25** | .43** | 0.02 | .30** | 0.12* |
| Personal Relevance | .33** | -0.07 | .57** | 0.26** | .35** | 0.22** |
| Collaboration | .42** | 0.11* | .51** | 0.16** | .28** | 0.13* |
| Multiple Regression (<i>R</i>) | | .70** | | .69** | | .41** |

N = 574 students in 31 classes.

p* < .05; *p* < .01.

5.3.1 Associations between the Learning Environment and Students' Self-Efficacy

The simple correlation results, reported in Table 5.3, suggested that self-efficacy was statistically significantly (*p* < .01) and positively related to all nine scales of the CCQ-P. These results suggested that the more positively students perceived the learning environment, the more students experienced self-efficacy.

The multiple regression coefficient (R) between the nine scales of the CCQ-P and students' self-efficacy was .70 and was statistically significant ($p < .01$). Analysis of the regression coefficients (β) indicated that five of the nine CCQ-P scales were statistically significantly and positively related to self-efficacy: Student Cohesiveness ($\beta = 0.10, p < .01$); Task Clarity ($\beta = 0.34, p < .01$); Involvement ($\beta = 0.29, p < .01$); Task Orientation ($\beta = 0.25, p < .01$); and Collaboration ($\beta = 0.11, p < .05$).

5.3.2 Associations between the Learning Environment and Students' Enjoyment of Class

The simple correlation results (reported in Table 5.3) indicated that there were statistically significant ($p < .05$) relationships between students' enjoyment of class and eight of the nine CCQ-P scales, the exception being the Student Cohesiveness scale. All of the statistically significant correlations were positive, suggesting that the more positively students perceived the learning environment, the more students enjoyed the class.

The multiple regression coefficient (R) between the nine scales of the CCQ-P and the Enjoyment of Class scale (reported at the bottom of Table 5.3) was .69 and was statistically significant ($p < .01$). The standardised regression coefficients (β), examined to determine which of the CCQ-P scales contributed to the variance in students' enjoyment of class, indicated that three of the nine CCQ-P scales made statistically significant ($p < .01$) and positive contributions to students' enjoyment of class: Teacher Support ($\beta = 0.18$), Personal Relevance ($\beta = 0.26$), and Collaboration ($\beta = 0.16$).

5.3.3 Associations between the Learning Environment and Students' Enjoyment of Using ICT

The simple correlation results (reported in Table 5.3) indicated that students' enjoyment of using ICT was statistically significantly ($p < .01$) and positively related to all nine scales of the CCQ-P. These results suggested that the more positively students perceived the learning environment, the more students enjoyed the use of ICT.

The multiple regression coefficient (R) between the nine scales of the CCQ-P and the Enjoyment of ICT scale (reported at the bottom of Table 5.3) was .41 and was statistically significant ($p < .01$). The regression coefficients (β), examined to determine which of the CCQ-P scales contributed to the variance in students' enjoyment of using ICT, indicated that three of the nine CCQ-P scales made statistically significant ($p < .01$) and positive contributions to students' enjoyment of using ICT: Task Orientation ($\beta = 0.12$, $p < .05$); Personal Relevance ($\beta = 0.22$, $p < .01$); and Collaboration ($\beta = 0.13$, $p < .05$).

This section (Section 5.3) has summarised the results related to the relationships between students' perceptions of their learning environment and their self-reports of self-efficacy, enjoyment of class, and enjoyment of using ICT (research objective 3). The following section (Section 5.4) examines the results of the present survey related to research objective 4.

5.4 Associations between the Use of ICT and Student Outcomes

The fourth research objective for the present study sought to examine the relationships between students' use of ICT and their self-reports of self-efficacy, enjoyment of their class, and enjoyment of ICT. Simple correlation analysis was used to examine the bivariate relationships between the ICT Usage Survey and SEEQ scales, using the students as the unit of analysis. Multiple regression analysis (R) was then used to provide a more parsimonious picture of the joint influence of the correlated ICT scales on the three student outcomes (self-efficacy, enjoyment of class, and enjoyment of using ICT) and to reduce the Type I error rate. Using the SEEQ scales as the independent variables and the ICT Usage Survey scales as the dependent variables, standardised regression coefficients (β) were examined to identify which of the ICT Usage Survey scales contributed uniquely and significantly to explaining the variance in students' self-efficacy and enjoyment.

The results of these analyses are reported in relation to students' self-efficacy (Section 5.4.1); enjoyment of class (Section 5.4.2); and enjoyment of using ICT (Section 5.4.3). Table 5.4 provides a summary of these results.

5.4.1 Associations between the Use of ICT and Students' Self-Efficacy

The simple correlation results, reported in Table 5.4, suggested that statistically significant ($p < .01$) and positive relationships existed between all five scales of the ICT Usage Survey and self-efficacy. These results suggested that the more positively students perceived the use of ICT, the more students experienced self-efficacy.

The multiple regression coefficient (R) between the five scales of the ICT Usage Survey and the Self-Efficacy scale was .29 and was statistically significant ($p < .01$). Examination of the regression coefficients (β) indicated that of the five ICT Usage Survey scales, only one, Changing Trends ($\beta = 0.12$, $p < .05$), was a statistically significant predictor of student self-efficacy. The relationship between the Changing Trends and Self-Efficacy scales was positive, suggesting that when students use technology in new ways which enhance the learning experience, they feel a sense of self-efficacy.

Table 5.4. Simple correlation and multiple regression results for associations between the ICT Usage Survey and SEEQ scales

| ICT Usage Survey Scale | SEEQ Scale | | | | | |
|---|---------------|---------|--------------------|---------|------------------|---------|
| | Self-Efficacy | | Enjoyment of Class | | Enjoyment of ICT | |
| | <i>r</i> | β | <i>r</i> | β | <i>r</i> | β |
| Investigating with ICT | .21** | 0.07 | .43** | 0.37** | .34** | 0.12** |
| Communicating with ICT | .22** | 0.08 | .18** | -0.50 | .27** | -0.03 |
| Applying Social and Ethical Protocols and Practices | .22** | 0.08 | .29** | 0.11* | .27** | -0.01 |
| Managing and Operating ICT Effectively | .22** | 0.02 | .25** | 0.05 | .33** | 0.02 |
| Changing Trends | .25** | 0.12* | .26** | 0.01 | .52** | 0.47** |
| Multiple Regression (R) | | .29** | | .45** | | .53** |

$N = 574$ students in 31 classes.

* $p < .05$; ** $p < .01$.

5.4.2 Associations between the Use of ICT and Students' Enjoyment of Class

The simple correlation results, reported in Table 5.4, indicated that, without exception, there were statistically significant ($p < .01$) and positive relationships between the Enjoyment of Class scale and the five scales of the ICT Usage Survey. These results suggested that the more positively students perceived the use of ICT, the more students experienced enjoyment of their class.

The multiple regression coefficient (R) between the five ICT Usage Survey scales and the Enjoyment of Class scale (reported at the bottom of Table 5.4) was .45, and statistically significant ($p < .01$). To examine which scales were likely to contribute to the variance in students' enjoyment of class, the standardised regression coefficients (β) were examined. The results indicated that two scales, Investigating with ICT ($\beta = 0.37, p < .01$) and Applying Social and Ethical Protocols and Practices ($\beta = 0.11, p < .05$), were statistically significantly and positively related to students' enjoyment of their class.

5.4.3 Associations between the use of ICT and Students' Enjoyment of Using ICT

The simple correlation results indicated that, without exception, there were statistically significant ($p < .01$) and positive relationships between the Enjoyment of ICT scale and all five scales of the ICT Usage Survey. These results suggested that the more positively students perceived the use of ICT, the more students enjoyed using technology.

The multiple regression coefficient (R) for the five scales of the ICT Usage Survey and the Enjoyment of ICT scale (reported at the bottom of Table 5.4) was .53 and was statistically significant ($p < .01$). The regression coefficients (β) indicated that two scales were statistically significantly ($p < .01$) and positively related to the Enjoyment of ICT scale: Investigating with ICT ($\beta = 0.12$) and Changing Trends ($\beta = 0.47$).

This section (Section 5.4) has summarised the results related to the relationships between students' perceptions of their use of ICT within the classroom and their self-

reports of self-efficacy, enjoyment of class, and enjoyment of using ICT (research objective 4). The following section (Section 5.5) examines the results of the present survey related to research objective 5.

5.5 Gender Differences

The fifth research objective of the present study sought to examine whether male and female primary school students differed in terms of their perceptions of their learning environment (Section 5.5.1); their use of ICT (Section 5.5.2); and their self-reported self-efficacy, enjoyment of class, and enjoyment of ICT use (Section 5.5.3).

Within the matched sample of 574 students used in the present study, 283 (49%) of the students were male and 291 (51%) were female. To examine the differences between the male and female students' responses to the three surveys used in the present study, the average item means for male and female students were calculated and compared for each survey scale. Using the class mean as the unit of analysis, effect sizes were calculated (as recommended by Thompson, 2001) to determine the magnitude of the differences between the scores of male and female students.

A MANOVA was used to examine whether the responses of male and female students were statistically significant. The learning environment, ICT usage and student affective outcomes (self-efficacy, enjoyment of class, and enjoyment of using ICT) were the dependent variables, and student gender was used as the independent variable. As the multivariate test using Wilks's lambda criterion (Wilks, 1935), showed that statistically significant differences were present, the univariate one-way ANOVA was interpreted for each scale.

This section reports the results of these analyses. Gender differences are examined in students' perceptions of their learning environment (Section 5.5.1); students' perceptions of their use of ICT (Section 5.5.2); and students' self-reported self-efficacy, enjoyment of class, and enjoyment of ICT use (Section 5.5.3).

5.5.1 Gender Differences in Learning Environment Perceptions

The average item means for male and female students' responses to the scales of the CCQ-P are reported in Table 5.5 and portrayed graphically in Figure 5.2. These results indicated that, for all but one of the nine CCQ-P scales, female students responded more favourably than males. The Personal Relevance scale was the exception, for which, males responded more positively than females.

A one-way MANOVA was used to determine whether the differences between male and female students' perceptions of the learning environment were statistically significant. The results, summarised in Table 5.5, indicated that the average item mean for female students was higher than the average item mean for male students for all scales, with the exception of the Personal Relevance scale. The differences between the responses of males and females were statistically significant for five of the nine CCQ-P scales: Teacher Support ($p < .05$), Equity ($p < .05$), Task Clarity ($p < .05$), Responsibility for Learning ($p < .05$), and Task Orientation ($p < .01$). Given that the mean differences were statistically significantly different from zero for these five scales, it is unlikely that the observed differences occurred by chance. Hence, for these five scales, the null hypothesis can be rejected.

Table 5.5. Average item means, average item standard deviations, and differences between means (effect sizes and MANOVA results) for male and female students' responses to the CCQ-P

| CCQ-P Scale | Average Item Mean | | Average Item Standard Deviation | | Difference between Means | |
|-----------------------------|-------------------|--------|---------------------------------|--------|--------------------------|----------|
| | Male | Female | Male | Female | Effect Size | <i>F</i> |
| Student Cohesiveness | 4.16 | 4.24 | 0.70 | 0.60 | 0.12 | 2.59 |
| Teacher Support | 3.90 | 4.06 | 0.84 | 0.80 | 0.20 | 5.01* |
| Equity | 3.82 | 3.99 | 0.90 | 0.84 | 0.20 | 5.39* |
| Task Clarity | 4.17 | 4.31 | 0.77 | 0.64 | 0.20 | 5.87* |
| Responsibility for Learning | 3.94 | 4.08 | 0.75 | 0.75 | 0.19 | 5.28* |
| Involvement | 3.49 | 3.53 | 0.93 | 0.88 | 0.04 | 0.21 |
| Task Orientation | 4.29 | 4.51 | 0.72 | 0.53 | 0.35 | 18.84** |
| Personal Relevance | 3.90 | 3.83 | 0.92 | 0.93 | -0.08 | 0.81 |
| Collaboration | 3.80 | 3.84 | 0.80 | 0.77 | 0.05 | 0.61 |

N = 283 males and 291 females.

***p* < .01; **p* < .05.

The effect size is the difference in means expressed in standard deviation units and was calculated using the formula: $d = M_1 - M_2 / \sqrt{(\sigma_1^2 + \sigma_2^2) / 2}$.

To determine the magnitude of the differences between the perceptions of male and female students in relation to the learning environment, effect sizes were calculated. The effect sizes for the five scales with statistically significant differences ranged from 0.19 standard deviations (for the Responsibility for Learning scale) to 0.35 standard deviations (for the Task Orientation scale). According to Cohen's (2013) criteria, these effect sizes can be considered small in magnitude. Given that the differences in actual responses of male and female students in relation to their learning environment were

not of practical significance according to Cohen's (2013) criteria, the preferred responses were not examined.

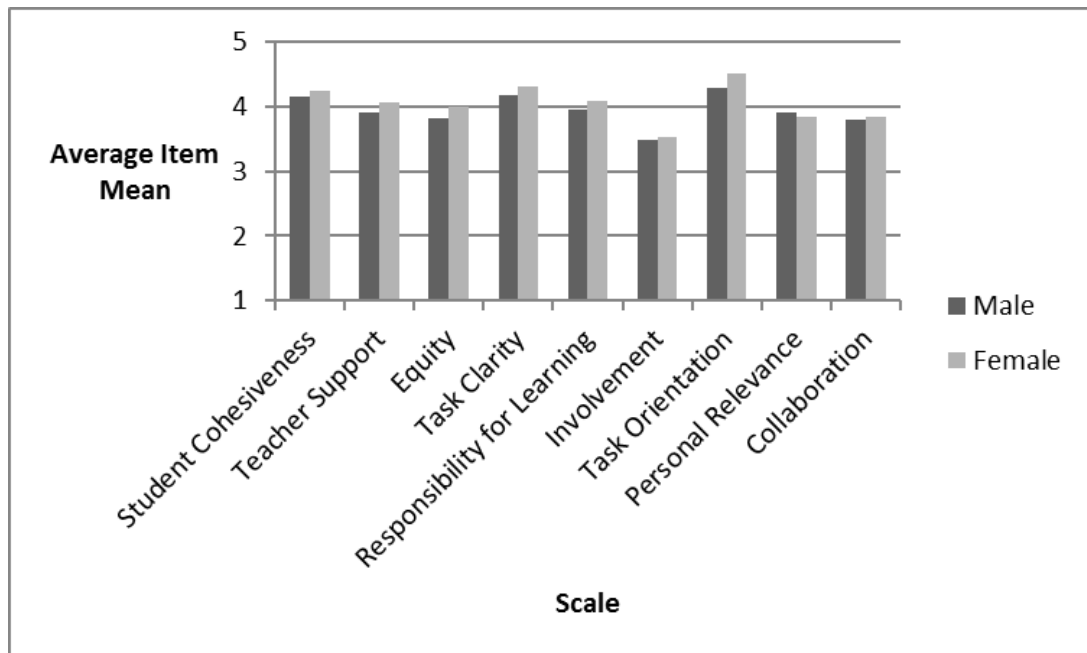


Figure 5.2. Average item means for male and female students' responses to the CCQ-P

5.5.2 Gender Differences in ICT Usage

The average item means for male and female students for the scales of the ICT Usage Survey are reported in Table 5.6 and portrayed graphically in Figure 5.3. The results indicated that, for all five scales, female students reported more positive perceptions than their male counterparts. The results of the MANOVA showed that the difference between the scores of male and female students was only statistically significant ($p < .01$) for one scale, namely, Communicating with ICT. The effect size for this scale was 0.23 standard deviations which, according to Cohen's (2013) criteria, is small in magnitude, suggesting that the results were not of practical significance.

Table 5.6. Average item means, average item standard deviations, and differences between means (effect sizes and MANOVA results) for male and female students' responses to the ICT Usage Survey

| ICT Usage Survey Scale | Average Item Mean | | Average Item Standard Deviation | | Difference between Means | |
|---|-------------------|--------|---------------------------------|--------|--------------------------|----------|
| | Male | Female | Male | Female | Effect Size | <i>F</i> |
| Investigating with ICT | 3.25 | 3.26 | 1.01 | 1.02 | 1.99 | 0.05 |
| Communicating with ICT | 2.37 | 2.61 | 1.00 | 1.09 | 0.23 | 6.82** |
| Applying Social and Ethical Protocols and Practices | 3.67 | 3.73 | 1.09 | 1.16 | 0.05 | 0.31 |
| Managing and Operating ICT Effectively | 3.01 | 3.02 | 0.98 | 0.97 | 0.01 | 0.04 |
| Changing Trends | 3.26 | 3.34 | 0.90 | 0.89 | 0.09 | 0.86 |

N = 283 males and 291 females.

***p* < .01; **p* < .05.

The effect size is the difference in means expressed in standard deviation units and was calculated using the formula: $d = M_1 - M_2 / \sqrt{[(\sigma_1^2 + \sigma_2^2) / 2]}$.

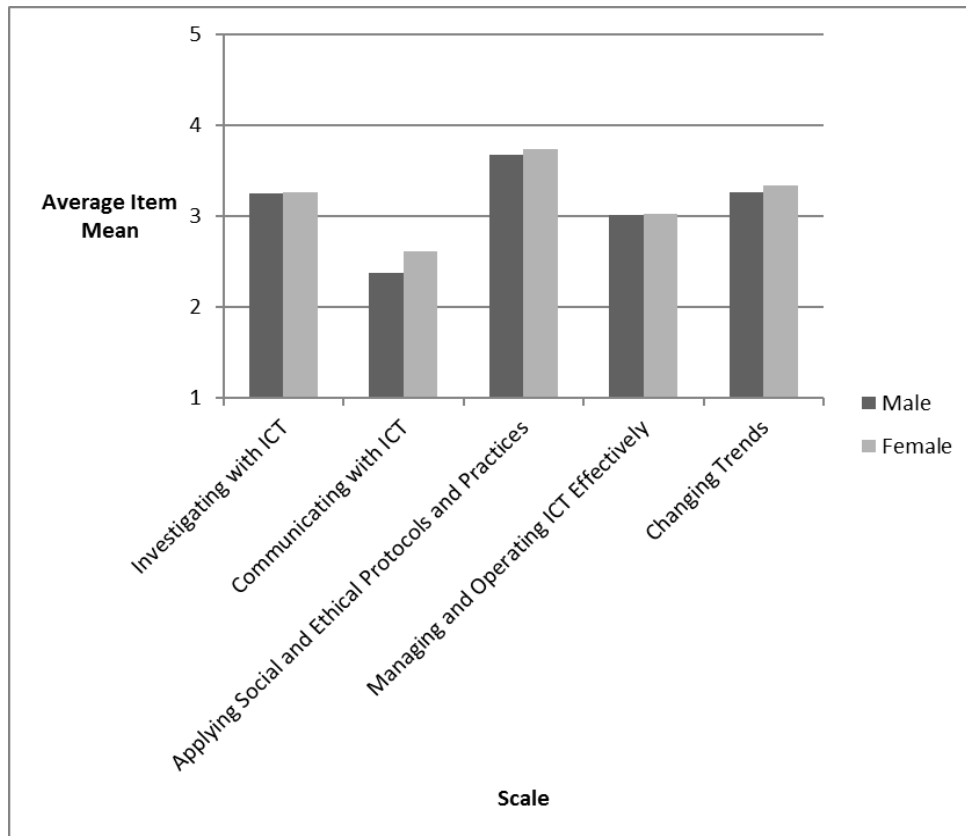


Figure 5.3. Average item means for male and female responses to the ICT Usage Survey

5.5.3 Gender Differences in Self-Efficacy and Enjoyment

The average item means for the three student outcome scales (Self-Efficacy, Enjoyment of Class, and Enjoyment of ICT) are reported in Table 5.7 and portrayed graphically in Figure 5.4. The results indicated that for self-efficacy and enjoyment of class, females reported more positive perceptions than males. However, for the Enjoyment of ICT scale, males reported more positive perceptions than females. The MANOVA results indicated that the difference between the scores of males and females was statistically significant ($p < .01$) for only the Self-Efficacy scale. The effect size for this scale was 0.29 standard deviations, which, according to Cohen's (2013) criteria, is small in magnitude. This result suggests that females have more favourable perceptions in terms of their confidence and belief in their own ability to successfully perform learning tasks than their male counterpart.

Table 5.7. Average item means, average item standard deviations, and differences between means (effect sizes and MANOVA results) for male and female students' responses to the SEEQ

| SEEQ Scale | Average Item Mean | | Average Item Standard Deviation | | Difference between Means | |
|--------------------|-------------------|---------|---------------------------------|---------|--------------------------|----------|
| | Males | Females | Males | Females | Effect Size | <i>F</i> |
| Self-Efficacy | 3.72 | 3.94 | 0.82 | 0.70 | 0.29 | 12.96** |
| Enjoyment of Class | 3.82 | 3.93 | 1.01 | 0.90 | 0.11 | 1.96 |
| Enjoyment of ICT | 4.09 | 4.04 | 0.94 | 0.92 | 0.05 | 0.45 |

N = 283 males and 291 females.

***p* < .01.

The effect size is the difference in means expressed in standard deviation units and was calculated using the formula: $d = M_1 - M_2 / \sqrt{(\sigma_1^2 + \sigma_2^2) / 2}$.

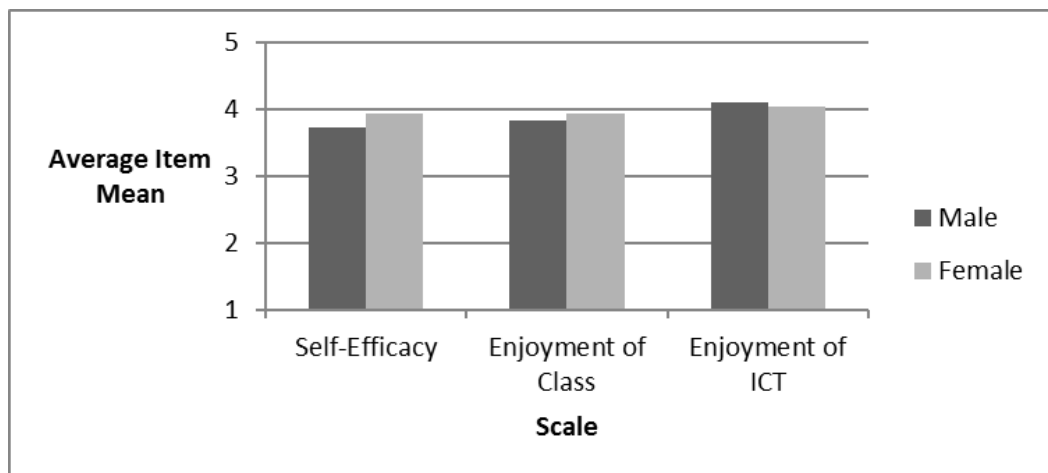


Figure 5.4. Average item means for male and female students' responses to the SEEQ

This section (Section 5.5) has summarised the results related to the differences between the perceptions of male and female students in relation to their learning environment, use of ICT in the classroom, and their self-reported affective outcomes of self-efficacy, enjoyment of class, and enjoyment of using ICT (research objective 5). The results indicated that female students reported more positive perceptions than males of their learning environment, use of ICT and affective outcomes with only two

exceptions. The exceptions were the Personal Relevance scale in the CCQ-P and the Enjoyment of ICT scale in the SEEQ, where males reported more positive perceptions than females. One-way MANOVA results indicated that the differences between the responses of males and females were statistically significant for five of the nine CCQ-P scales (Teacher Support, Equity, Task Clarity, Responsibility for Learning, and Task Orientation), one of the five ICT Usage Survey scales (Communicating with ICT), and one of the three SEEQ scales (Self-Efficacy). In each case, the effect sizes suggested that, according to Cohen's (2013) criteria, these differences were small in effect. The following section (Section 5.6) examines the results of the present survey related to research objective 6.

5.6 Differences Between the Perceptions of At-Risk and Not-At-Risk Students

Research objective 6 for the present study sought to examine whether the perceptions of primary school students who were considered to be academically at risk differed from the perceptions of their counterparts who were not considered to be at risk. Differences were examined in terms of students' learning environment perceptions (Section 5.6.1); their use of ICT (Section 5.6.2); and their self-efficacy, enjoyment of class, and use of ICT (Section 5.6.3).

Data analysis for this objective involved comparing the responses of the 170 students who were considered to be academically at risk (that is, at or below the national minimum standard in either literacy or numeracy) with the responses of the 404 students who were not considered to be at risk (that is, above the national minimum standard in both literacy and numeracy). Given that the number of at-risk students was different to the number of not-at-risk students, the mean for at-risk students, and those that were not, were calculated (note that all classes had a minimum of three students who were considered to be at risk). These values, the class mean for the two groups, then were used as the unit of analysis. As was the case for research objectives 2 (see Section 5.2) and 5 (see Section 5.5), the statistical significance of the differences related to this objective were examined using MANOVA, with the learning environment scales (CCQ-P), ICT Usage Survey scales, and student affective outcomes (self-efficacy, enjoyment of class, and enjoyment of ICT use) as the

dependent variables and students' at risk status as the independent variable. To examine the magnitude of the differences, effect sizes were calculated.

5.6.1 Differences in Learning Environment Perceptions for At-Risk and Not-At-Risk Students

This section examines the differences between academically at-risk and not-at-risk students in terms of their perceptions of their actual learning environments (Section 5.6.1.1). This section also examines the differences between the actual and preferred learning environment perceptions of these two groups of students (Section 5.6.1.2).

5.6.1.1 Differences in Perceptions of the Actual Learning Environment for At-Risk and Not-At-Risk Students

The average item means reported in Table 5.8 and portrayed graphically in Figure 5.5, indicated that, for all scales of the CCQ-P, students who were not at risk reported more positive perceptions of their actual learning environment than their academically at-risk classmates did. In all cases, the average item standard deviations were lower for not-at-risk students than for those at risk, indicating a slightly narrower spread of scores for not-at-risk students.

To examine whether these differences were statistically significant, a one-way MANOVA was used. As the multivariate test using Wilks's lambda criterion (Wilks, 1935), showed that statistically significant differences were present, the univariate one-way ANOVA was interpreted for each scale. The results, reported in Table 5.8, indicated that there were statistically significant differences between the perceptions of not-at-risk students and at-risk students ($p < .05$) for four of the nine CCQ-P scales: Equity, Task Clarity, Responsibility for Learning, and Task Orientation. The effect sizes for these four scales, calculated to provide an indication of the magnitude of the differences, ranged between 0.57 and 1.04 standard deviations. According to Cohen's (2013) criteria, the effect sizes for the Equity and Responsibility for Learning scales (both 0.57) were moderate in magnitude, and the effect sizes for the Task Clarity (1.04) and Task Orientation (0.92) scales were large, making the results for all four scales of educational significance.

Table 5.8. Average item means, average item standard deviations, and differences in means (effect sizes and MANOVA results) for not-at-risk students and at-risk students responses to the CCQ-P

| CCQ-P Scale | Average Item Mean | | Average Item Standard Deviation | | Difference between Means | |
|-----------------------------|-------------------|---------|---------------------------------|---------|--------------------------|----------|
| | Not-At-Risk | At-Risk | Not-At-Risk | At Risk | Effect Size | <i>F</i> |
| Student Cohesiveness | 4.31 | 4.24 | 0.15 | 0.37 | 0.25 | 0.97 |
| Teacher Support | 4.09 | 3.97 | 0.41 | 0.53 | 0.25 | 0.91 |
| Equity | 4.01 | 3.74 | 0.41 | 0.53 | 0.57 | 4.87* |
| Task Clarity | 4.36 | 4.00 | 0.23 | 0.43 | 1.04 | 15.90** |
| Responsibility for Learning | 4.12 | 3.91 | 0.32 | 0.41 | 0.57 | 4.75* |
| Involvement | 3.65 | 3.58 | 0.35 | 0.45 | 0.17 | 0.42 |
| Task Orientation | 4.50 | 4.20 | 0.19 | 0.42 | 0.92 | 11.86** |
| Personal Relevance | 4.02 | 3.87 | 0.34 | 0.54 | 0.33 | 1.45 |
| Collaboration | 3.95 | 3.84 | 0.31 | 0.53 | 0.25 | 0.94 |

N = 404 not-at-risk students and 170 at-risk students in 31 classes

p* < .05; *p* < .01

The class mean for the two groups (those who were considered to be at-risk and those who were not) was used as the unit of analysis.

5.6.1.2 Differences in the Actual and Preferred Learning Environment Perceptions of Not-At-Risk Students and At-Risk Students

Whereas the previous section examined differences in terms of the perceptions of the actual learning environment for students who were considered to be academically at risk and those who were not, this section examines differences between these groups of students in terms of their actual–preferred differences in learning environment perceptions. Given that these two groups of students reported different experiences of the actual learning environment (as reported in Section 5.6.1.1), an ANCOVA was used to examine the differences in the students’ actual and preferred learning environment perceptions. The use of an ANCOVA allowed the students’ preferred scores on the learning environment scales to be referenced against their actual scores and then compared between the two groups of students.

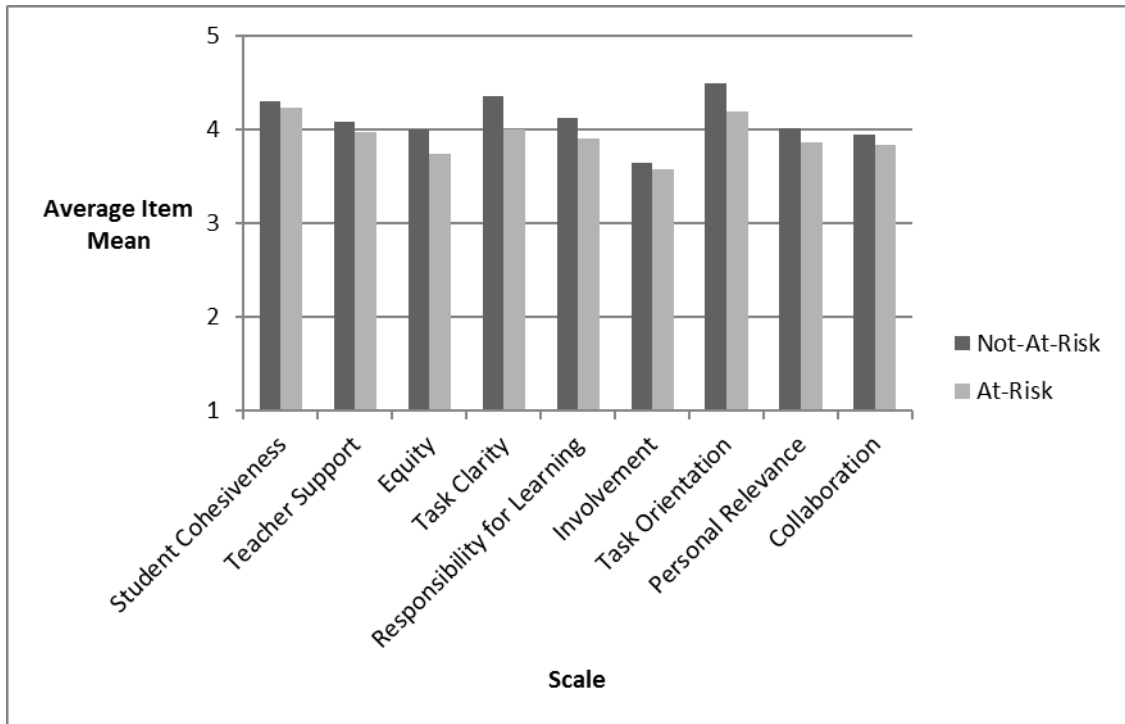


Figure 5.5. Average item means for not-at-risk students and at-risk students for the CCQ-P

After the scores were adjusted (see Table 5.9), there was only one scale—Task Clarity—for which there was a statistically significant difference between the preferred scores of the at-risk students and those who were not at risk ($F = 3.94$, $p < .05$; see Table 5.10). The mean preferred score (reported in Table 5.9) for Task Clarity, after adjusting for the corresponding actual scores, was higher for the students who were not-at-risk than for those who were at risk.

The magnitude of the differences (after adjustment) between the actual and preferred learning environment perceptions of academically at-risk students and those who were not at risk was examined using effect sizes. The η^2 statistic (representing the effect size) provided a measure of the variance in the actual items after excluding the variance that was explained by the preferred item means. The effect sizes, reported in Table 5.10, were all small according to Thalheimer and Cook's (2002) guidelines.

Table 5.9. Adjusted and unadjusted means and variability for preferred learning environment perceptions with actual learning environment perceptions used as covariates

| CCQ-P Scale | At-Risk | | | | Not-At-Risk | | | |
|-----------------------------|------------|------|----------|------|-------------|------|----------|------|
| | Unadjusted | | Adjusted | | Unadjusted | | Adjusted | |
| | Mean | SD | Mean | SE | Mean | SD | Mean | SE |
| Student Cohesiveness | 4.53 | | | 0.03 | | 0.14 | 4.62 | 0.03 |
| Teacher Support | 4.28 | 0.41 | 4.32 | 0.04 | 4.40 | 0.28 | 4.37 | 0.04 |
| Equity | 4.26 | 0.34 | 4.33 | 0.05 | 4.46 | 0.32 | 4.40 | 0.05 |
| Task Clarity | 4.46 | 0.32 | 4.52 | 0.05 | 4.71 | 0.17 | 4.66 | 0.08 |
| Responsibility for Learning | 4.21 | 0.36 | 4.27 | 0.04 | 4.33 | 0.24 | 4.26 | 0.04 |
| Involvement | 4.06 | 0.47 | 4.08 | 0.07 | 4.09 | 0.34 | 4.07 | 0.07 |
| Task Orientation | 4.46 | 0.37 | 4.56 | 0.04 | 4.72 | 0.18 | 4.62 | 0.04 |
| Personal Relevance | 4.27 | 0.38 | 4.30 | 0.05 | 4.38 | 0.27 | 4.35 | 0.05 |
| Collaboration | 4.25 | 0.39 | 4.56 | 0.04 | 4.28 | 0.28 | 4.62 | 0.04 |

N = 404 not-at-risk students and 170 at-risk students in 31 classes

The class mean for the two groups (those who were considered to be at-risk and those who were not) was used as the unit of analysis.

Table 5.10. Differences between the preferred learning environment perceptions for not-at-risk students and at-risk students after adjustment for the corresponding actual scores

| Scale | Difference between the Preferred Responses of At-Risk and Not-At-Risk Students | |
|-----------------------------|--|----------|
| | Effect Size | <i>F</i> |
| Student Cohesiveness | .04 | 2.34 |
| Teacher Support | .01 | 0.71 |
| Equity | .02 | 1.04 |
| Task Clarity | .07 | 3.94* |
| Responsibility for Learning | .00 | 0.01 |
| Involvement | .00 | 0.01 |
| Task Orientation | .02 | 1.36 |
| Personal Relevance | .01 | 0.51 |
| Collaboration | .02 | 1.36 |

N = 404 not-at-risk students and 170 at-risk students in 31 classes

**p* < .05

5.6.2 Differences in ICT Usage Perceptions for At-Risk Students and Not-At-Risk Students

This section examines differences between the perceptions of academically at-risk students and those who were not at risk in terms of the use of ICT within the classroom environment. The average item means, reported in Table 5.11 and portrayed graphically in Figure 5.6, indicated that students who were not considered to be at risk reported more positive perceptions than their at-risk classmates for three of the five ICT Usage Survey scales: Investigating with ICT, Applying Social and Ethical Protocols and Practices, and Changing Trends. Conversely, for the remaining two scales, at-risk students reported more positive perceptions than their classmates who were not at risk: Communicating with ICT and Managing and Operating ICT Effectively.

Table 5.11. Average item means, average item standard deviations, and differences between means (effect sizes and MANOVA results) for not-at-risk students and at-risk students for the ICT Usage Survey

| ICT Usage Survey Scale | Average Item Mean | | Average Item Standard Deviation | | Difference between Means | |
|---|-------------------|---------|---------------------------------|---------|--------------------------|----------|
| | Not-At-Risk | At-Risk | Not-At-Risk | At-Risk | Effect Size | <i>F</i> |
| Investigating with ICT | 3.30 | 3.15 | 1.01 | 1.01 | .15 | 2.18 |
| Communicating with ICT | 2.44 | 2.63 | 1.06 | 1.04 | .18 | 3.53 |
| Applying Social and Ethical Protocols and Practices | 3.81 | 3.43 | 1.12 | 1.11 | .34 | 12.71** |
| Managing and Operating ICT Effectively | 3.00 | 3.05 | 0.97 | 0.97 | .05 | 0.37 |
| Changing Trends | 3.36 | 3.16 | 0.88 | 0.93 | .22 | 5.68* |

N = 404 not-at-risk students and 170 at-risk students.

***p* < .01; **p* < .05.

The effect size is the difference in means expressed in standard deviation units and was calculated using the formula: $d = M_1 - M_2 / \sqrt{[(\sigma_1^2 + \sigma_2^2) / 2]}$.

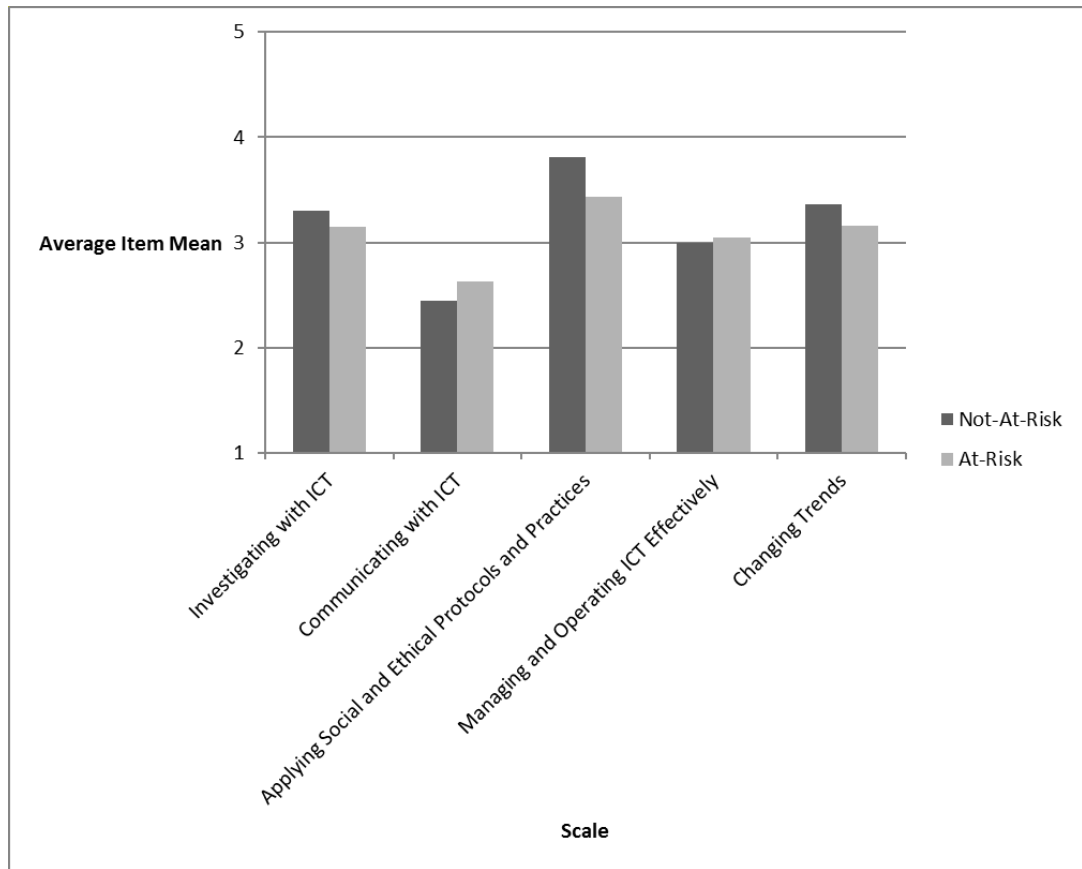


Figure 5.6. Average item means for not-at-risk students and at-risk students for the actual version of the ICT Usage Survey

To determine whether these differences were statistically significant, a one-way MANOVA was used. As the multivariate test using Wilks's lambda criterion (Wilks, 1935), showed that statistically significant differences were present, the univariate one-way ANOVA was interpreted for each scale. The results, reported in Table 5.11, indicated that the differences were statistically significant for two of the five ICT Usage Survey scales: Applying Social and Ethical Protocols and Practices ($p < .01$) and Changing Trends ($p < .05$). For both of these scales, the average item means for the academically at-risk students were lower than those of the students who were not at risk.

The effect sizes for the two scales with statistically significant differences in mean scores were 0.34 standard deviations for the Applying Social and Ethical Protocols and Practices scale and 0.22 standard deviations for the Changing Trends scale. According to Cohen’s (2013) criteria, these effect sizes are small.

5.6.3 Differences in Self-Efficacy and Enjoyment for At-Risk Students and Not-At-Risk Students

This section reports on the differences between the perceptions of academically at-risk students and those who were not at risk for the SEEQ scales (Self-Efficacy, Enjoyment of Class, and Enjoyment of ICT). The average item means, reported in Table 5.12 and portrayed graphically in Figure 5.7, indicated that, for all scales, students who were not at risk had more positive self-reports than those who were considered to be academically at risk.

Table 5.12. Average item means, average item standard deviations, and differences between means (effect sizes and MANOVA results) for not-at-risk students and at-risk students for the SEEQ

| SEEQ Scale | Average Item Mean | | Average Item Standard Deviation | | Differences between Means | |
|--------------------|-------------------|---------|---------------------------------|---------|---------------------------|----------|
| | Not-At-Risk | At-Risk | Not-At-Risk | At-Risk | Effect Size | <i>F</i> |
| Self-Efficacy | 4.00 | 3.72 | 0.18 | 0.51 | .73 | 7.75** |
| Enjoyment of Class | 4.03 | 3.76 | 0.44 | 0.71 | .46 | 3.12* |
| Enjoyment of ICT | 4.10 | 4.01 | 0.38 | 0.38 | .24 | 0.88 |

N = 404 not-at-risk students and 170 at-risk students.

p* < .05; *p* < .01

The effect size is the difference in means expressed in standard deviation units and was calculated using the formula: $d = M1 - M2 / \sqrt{(\sigma1^2 + \sigma2^2) / 2}$.

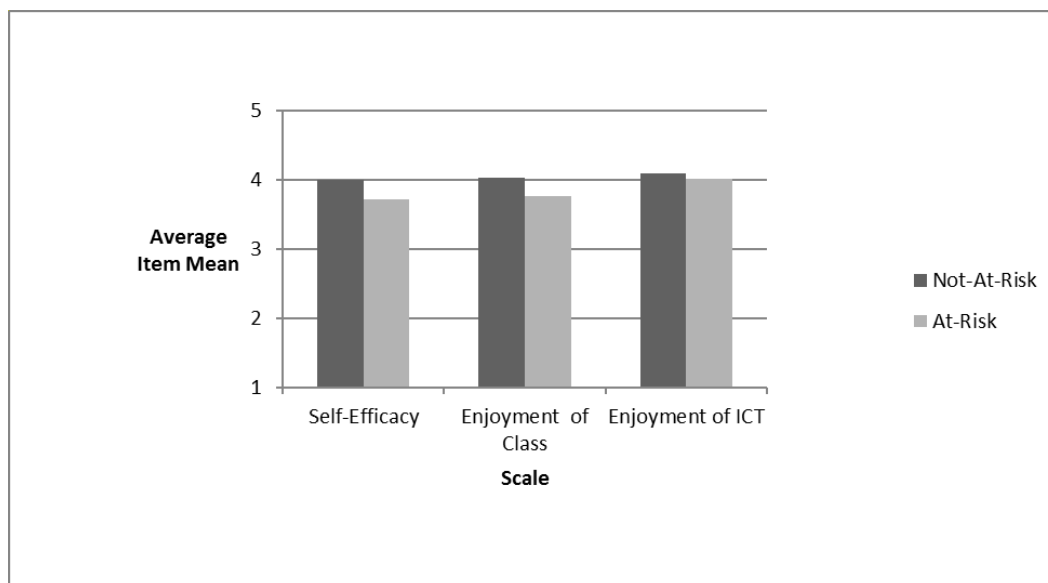


Figure 5.7. Average item means for not-at-risk students and at-risk students for the SEEQ

The MANOVA results indicated that these differences were statistically significant, for two of the three scales: Self-Efficacy ($p < .01$) and Enjoyment of Class ($p < .05$). The effect sizes for these two scales were 0.73 standard deviations for the Self-Efficacy scale and 0.48 standard deviations for the Enjoyment of Class scale. According to Cohen's (2013) criteria, these effect sizes can be considered large and of practical significance.

This section (Section 5.6) has reported the results related to the differences between the perceptions of academically at-risk students and students who were not at risk in relation to their learning environment, use of ICT in the classroom, and their self-reported affective outcomes of self-efficacy, enjoyment of class, and enjoyment of using ICT (research objective 6). The following section (Section 5.7) provides a summary of Chapter 5.

5.7 Chapter Summary

This chapter has reported the results that were obtained from analysis of the data collected using the three surveys developed for the purposes of the present study, namely, the Classroom Climate Questionnaire Primary (CCQ-P), the ICT Usage Survey and the Self-Efficacy and Engagement Questionnaire (SEEQ). The data

collected from a sample of 574 students in 31 classes across 12 schools were analysed to address research objectives 2 to 6. This section summarises the results reported in this chapter according each research objective.

5.7.1 Research Objective 2

Research objective 2 examined whether differences existed between primary school-aged students' actual and preferred perceptions of their learning environment (Section 5.2). To address this objective, descriptive statistics, MANOVA, and effect sizes were calculated.

The results (reported in Section 5.2.1) indicated that for eight of the nine learning environment scales, students scored higher for the preferred version than the actual version. For the exception, Task Orientation, students scored higher for the actual responses than preferred responses, indicating that they would prefer a lesser degree of Task Orientation than they currently perceive. A one-way MANOVA and subsequent univariate ANOVA indicated that there were statistically significant ($p < .01$) differences between the actual and preferred scores for all nine CCQ-P scales. According to Cohen's (2013) criteria, the effect sizes calculated for each scale indicated that the differences for all but two CCQ-P scales (Responsibility for Learning and Task Orientation) were medium in magnitude (greater than 0.40 standard deviations).

The results for the ICT Usage Survey (reported in Section 5.6.1.2) indicated that for both scales (Investigating with ICT and Communicating with ICT), students reported more positive preferred perceptions than actual perceptions. Results of a one-way MANOVA and subsequent univariate ANOVA indicated that there were statistically significant ($p < .01$) differences between the actual and preferred scores for both scales. The effect sizes calculated for each scale indicated that, according to Cohen's (2013) criteria, the differences between the actual and preferred scores were moderate in magnitude (greater than 0.50 standard deviations).

5.7.2 *Research Objective 3*

The third research objective sought to examine the relationships between students' perceptions of the learning environment and their self-reports of self-efficacy and enjoyment (Section 5.3). The results of the simple correlation suggested that statistically significant and positive relationships existed between all nine scales of the CCQ-P and the student outcomes of self-efficacy, enjoyment of class, and enjoyment of ICT (the only exception being the relationship between the Enjoyment of Class and Student Cohesiveness scales, which was positive but not statistically significant). The multiple regression coefficients (R) between the scales of the CCQ-P and the SEEQ scales of Self-Efficacy, Enjoyment of Class, and Enjoyment of ICT were all statistically significant ($p < .01$) and suggested positive associations between the learning environment and each of these three affective outcomes. Analysis of the regression coefficients (β) indicated that five of the nine CCQ-P scales were statistically significantly and positively related to self-efficacy: Student Cohesiveness ($\beta = 0.10, p < .01$), Task Clarity ($\beta = 0.34, p < .01$), Involvement ($\beta = 0.29, p < .01$), Task Orientation ($\beta = 0.25, p < .01$), and Collaboration ($\beta = 0.11, p < .05$). Three of the nine CCQ-P scales were statistically significantly ($p < .01$) and positively related to students' enjoyment of class: Teacher Support ($\beta = 0.18$), Personal Relevance ($\beta = 0.26$), and Collaboration ($\beta = 0.16$). Further, three CCQ-P scales were statistically significantly and positively related to students' enjoyment of using ICT: Task Orientation ($\beta = 0.12, p < .05$), Personal Relevance ($\beta = 0.22, p < .01$), and Collaboration ($\beta = 0.13, p < .05$).

5.7.3 *Research Objective 4*

The fourth research objective sought to examine the relationships between students' use of ICT and their self-reports of self-efficacy, enjoyment of class, and enjoyment of using ICT (Section 5.4). The simple correlation results suggested that statistically significant and positive relationships existed between all five scales of the ICT Usage Survey and all three SEEQ scales (Self-Efficacy, Enjoyment of Class, and Enjoyment of ICT). The multiple regression coefficients (R) between the scales of the ICT Usage Survey and the SEEQ scales (Self-Efficacy, Enjoyment of Class, and Enjoyment of ICT) were all statistically significant ($p < .01$) and positive. Analysis of the regression

coefficients (β) indicated that only one of the five ICT Usage Survey scales, Changing Trends, was statistically significantly ($\beta = 0.12, p < .05$) and positively related to self-efficacy. Two of the ICT Usage Survey scales, Investigating with ICT ($\beta = 0.37, p < .01$) and Applying Social and Ethical Protocols and Practices ($\beta = 0.11, p < .05$), were statistically significantly and positively related to students' enjoyment of class. Finally, two of the ICT Usage Survey scales, Investigating with ICT ($\beta = 0.12, p < .01$) and Changing Trends ($\beta = 0.47, p < .01$), were statistically significantly and positively related to students' enjoyment of using ICT.

5.7.4 Research Objective 5

The fifth research objective sought to examine differences in the perceptions of male and female primary school students in terms of their learning environments, use of ICT, and self-reports of self-efficacy, enjoyment of class, and enjoyment of using ICT (Section 5.5). Results of a MANOVA indicated that the differences between the perceptions of males and females were statistically significant for five of the nine CCQ-P scales: Teacher Support ($p < .05$), Equity ($p < .05$), Task Clarity ($p < .05$), Responsibility for Learning ($p < .05$), and Task Orientation ($p < .01$). A statistically significant difference between male and female students' perceptions was also identified for one scale of the ICT scale, Communicating with ICT ($p < .05$). In all cases, female students scored higher than their male counterparts. According to Cohen's (2013) criteria, the effect sizes indicated that each of these differences was small in effect (less than 0.40 standard deviations).

For the SEEQ, the results of the MANOVA showed differences between the scores of males and females, which were only statistically significant ($p < .01$) for only the Self-Efficacy scale, with females scoring higher than males. The effect size for this scale was modest in magnitude, according to Cohen's (2013) criteria.

5.7.5 Research Objective 6

The sixth research objective sought to examine differences in perceptions between academically at-risk students and those who were not at risk in terms of their perceptions of their learning environment; use of ICT; and self-efficacy, enjoyment of

their class, and enjoyment of ICT (Section 5.6). The results indicated that, for all of the CCQ-P and SEEQ scales, the at-risk students scored lower than those who were not at risk. Results of a one-way MANOVA and a univariate one-way ANOVA indicated that there were statistically significant differences ($p < .05$) for four of the nine CCQ-P scales— Equity, Task Clarity, Responsibility for Learning, and Task Orientation—and two of the three SEEQ scales—Self-Efficacy ($p < .01$) and Enjoyment of Class ($p < .05$). The effect sizes indicated that the magnitude of the difference for each scale with a statistically significant difference was high (above 0.5 standard deviations), according to Cohen’s (2013) criteria.

Given that academically at-risk and not-at-risk students reported different experiences of their *actual* learning environment, an ANCOVA was used to examine the differences in these students’ learning environment *preferences*. In this analysis, students’ preferred learning environment responses were used as the dependent variables, the corresponding responses related to the actual learning environment were the covariates, and the student type (at risk or not at risk) was the independent variable. After the scores were adjusted, the results indicated that a statistically significant difference existed only for the preferences of the at-risk and not-at-risk students for one of the nine learning environment scales, namely, Task Clarity ($F = 3.94, p < .05$). The mean preferred score for this scale was higher for the students who were not at risk than for those who were at risk.

For the ICT Usage Survey, the results of a one-way MANOVA and a univariate one-way ANOVA indicated that the scores for male and female students were statistically significantly different for two of the ICT Usage Survey scales: Applying Social and Ethical Protocols and Practices ($p < .01$) and Changing Trends ($p < .05$). The effect sizes for these two scales were small, according to Cohen’s (2013) criteria.

The data reported in this chapter complement those reported in Chapter 4 in terms of the results of the present study. The findings and implications of these results are the focus of the following chapter.

DISCUSSION

6.1 Introduction

This thesis reports a study that examined the perceptions of primary school students in relation to their learning environment and use of ICT as well as their self-reports of the outcomes of self-efficacy, enjoyment of class, and enjoyment of using ICT. Given the dearth of surveys suitable for examining these constructs in the primary school setting, it was necessary to develop and validate three new surveys to gather data for the purposes of the present study.

As explained in Section 3.4 of Chapter 3, the sample for the present study was purposively designed to ensure the inclusion of a representative range of schools, teachers, and classes. Twelve coeducational Catholic schools were involved in the study, reflecting a range of enrolment sizes, socioeconomic statuses, and locations within Western Australian (including metropolitan and regional locations). The total sample included 30 teachers and 31 classes from years 4, 5, and 6 (with one teacher administering the questionnaires to two classes). The questionnaires were administered to students who: (a) did not have a diagnosed learning disability; (b) provided their verbal consent; and (c) had written parent consent to participate. The selection of classes was made to ensure that each class included at least three students who were considered to be academically at risk.

To avoid survey fatigue, the surveys were administered on two days, with the CCQ-P¹³ and SEEQ¹⁴ being administered on the first day and the ICT Usage Survey¹⁵ being administered on the second day. Due to absences, the samples for the two administrations were different, with 609 students responding on the first day and 583 responding on the second day. To ensure that the data reflected students who had responded to surveys in both administrations, the responses were matched. Data for

¹³ Further information on the Classroom Climate Questionnaire Primary can be found in Section 4.2.

¹⁴ Further information on the Self-Efficacy and Enjoyment Questionnaire can be found in Section 4.4.

¹⁵ Further information on the ICT Usage Survey can be found in Section 4.3.

those students who were not present for both administrations was omitted from all analysis. The resulting sample included responses from 574 students, of whom 283 were male and 291 were female. The sample included 170 students identified as being at risk and 404 students who were not.

This chapter summarises and concludes the thesis by discussing the results that were described in Chapters 4 and 5 as well as the limitations and significance of the study.

This chapter is organised under the following headings:

- Summary and discussion of the findings (Section 6.2);
- Educational implications (Section 6.3);
- Limitations of the study (Section 6.4);
- Summary of recommendations (Section 6.5);
- Significance of the study (Section 6.6); and
- Concluding remarks (Section 6.7).

6.2 Summary and Discussion of the Findings

This section provides a summary and discussion of the results of the study. Corresponding to the six research objectives, the major findings are summarised and discussed in relation to: the development and validation of the instruments (Section 6.2.1; research objective 1); the actual and preferred differences reported by primary school students in terms of their perceptions of the learning environment and use of ICT (Section 6.2.2; research objective 2); associations between the learning environment and student affective outcomes (Section 6.2.3; research objective 3); associations between the use of ICT and affective outcomes (Section 6.2.4; research objective 4); differences in perceptions and outcomes according to gender (Section 6.2.5; research objective 5); and differences in perceptions and outcomes for at-risk students and those who were not at risk (Section 6.2.6; research objective 6).

6.2.1 Development and Validation of the Instruments

The first research objective of the present study was:

To develop and validate three surveys to assess primary school students’:

- a) Perceptions of the learning environment;
- b) Use of ICT; and
- c) Outcomes in terms of:
 - i. Self-efficacy;
 - ii. Enjoyment of their class; and
 - iii. Enjoyment of using ICT.

The development of each of the three surveys involved the same six steps: (a) a review of related literature; (b) the selection and development of relevant scales; (c) the modification and development of survey items; (d) the development of a suitable response format; (e) a review by an expert panel; and (f) the pilot testing of the survey instrument (see Section 3.5.1 of Chapter 3). Following this process, the surveys were administered online to students in 31 classes ranging from year 4 to year 6 across 12 schools.

The validity of each survey was examined using Trochim and Donnelly’s (2008) construct validity framework. First, the translation validity of each survey was confirmed through the review by an expert panel and the pilot study (as described in Section 4.2 of Chapter 4). Next, the data collected in the large-scale administration (across 31 classes) was analysed to provide evidence to support the criterion validity of each survey.

This section summarises the evidence to support the validity and reliability of each survey. The results are summarised separately for the CCQ-P (Section 6.2.1.1), the ICT Usage Survey (Section 6.2.1.2), and the SEEQ (Section 6.2.1.3).

6.2.1.1 *Validity and Reliability of the Classroom Climate Questionnaire Primary (CCQ-P)*

The CCQ-P was developed to assess students' perceptions of their classroom learning environment. The questionnaire comprised nine scales: Student Cohesiveness, Teacher Support, Equity, Task Clarity, Responsibility for Learning, Involvement, Task Orientation, Personal Relevance, and Collaboration. Each scale included five items, providing 45 items in total.

The key findings related to the validity and reliability of the CCQ-P are summarised below.

- Overall, the expert review panel affirmed the content validity of the CCQ-P. The panel also suggested simplifying the language of some items to improve the readability of the questionnaire for primary school-aged children. Some items were also omitted, based on feedback from the panel, to shorten the length of the questionnaire.
- The student pilot study also generally supported the face validity of the survey items as well as the use of a side-by-side actual–preferred five-point frequency response format. Based on the results of the pilot study, the language within some items was further simplified to improve the readability of the questionnaire for primary school aged children.
- One term within the response format (*seldom*) was also simplified (to *rarely*) to improve students' comprehension of the questionnaire. The final version of the five-point frequency response scale was: *almost never, rarely, sometimes, often* and *almost always*.
- Feedback from students following the survey administration indicated that they were able to understand the actual–preferred format and experienced no technical difficulties with the online format of the questionnaire.
- The final 45-item, nine-scale version of the CCQ-P displayed strong factorial validity for both the actual and preferred versions. Each item had a factor loading of at least .40 on its *a priori* scale and less than .40 on all other scales, with the exception of one item (in the actual version), which was, nonetheless, retained to strengthen the overall reliability of the scale.

The eigenvalues for all scales were above 1, and the total proportion of variance accounted for was high (at 65.88%), all of which satisfied Kaiser's (1960) recommendation that the eigenvalue for a factor should be greater than 1.

- The internal consistency reliability coefficients for each of the nine learning environment scales, calculated using Cronbach's alpha, were high (above 0.70) for both the actual and preferred versions. According to the criteria recommended by Cohen et al. (2011), these alpha reliability estimates support the internal consistency of all scales.
 - For the actual version, the alpha coefficients ranged from .81 to .91 using the individual as the unit of analysis, and from .78 to .93 using the class mean as the unit of analysis.
 - For the preferred version, the alpha coefficients for the different scales ranged from .83 to .92 using the individual as the unit of analysis, and from .82 to .94 (using the class mean as the unit of analysis).
- The correlation matrix, obtained through oblique rotation (for both the actual and preferred versions) indicated that all nine learning environment scales were distinct, with the highest correlation between any two scales being .58 for the actual version and .47 for the preferred version. According to Brown's (2014) criterion, given that these results were all below .80, the discriminant validity of the survey was supported.
- The ANOVA results (calculated using only the actual version) indicated that seven of the nine learning environment scales (Teacher Support, Task Clarity, Responsibility for Learning, Involvement, Task Orientation, Personal Relevance, and Collaboration) were able to differentiate statistically significantly ($p < .05$) between the perceptions of students in different classrooms. That is, students in the same class had similar perceptions of their learning environment but these perceptions were different to the perceptions of students in other classes which, theoretically, should occur thus providing evidence to suggest concurrent validity.
- The simple correlation results indicated that all nine scales of the CCQ-P were statistically significantly ($p < .01$) correlated with student self-efficacy. This finding supported the predictive validity of the CCQ-P.

The results outlined above provide compelling evidence to support the validity and reliability of the CCQ-P for use with primary school students. The quantitative results related to the validity of the CCQ-P data were comparable with those obtained in past research involving similar surveys at the secondary school level (see, for example, the validation of the COLES by Aldridge, Fraser, et al., 2012, reported in Section 2.2.3.6 of Chapter 2, and the validation of the WIHIC by Fraser et al., 1996, reported in Section 2.2.3.4 of Chapter 2).

The validation of the CCQ-P fills a gap in current research as, previously, no validated instruments existed that were suitable for assessing students' perceptions of the learning environment at the primary school level. Therefore, the development and validation of the CCQ-P make a unique contribution to learning environments research.

Despite the satisfactory results reported in this section, the CCQ-P was used for the first time in the present study, which involved students from the Western Australian Catholic schools. It is, therefore, recommended that future research examine the validity and reliability of the CCQ-P across a more diverse student sample, for example, across different education sectors and geographical contexts (*Recommendation 1a*).

6.2.1.2 Validity and Reliability of the ICT Usage Survey

The ICT Usage Survey was developed to assess students' use of ICT within the classroom environment. The survey was comprised of 36 items and 6 scales: Investigating with ICT, Creating with ICT, Communicating with ICT, Applying Social and Ethical Protocols and Practices, Changing Trends, and Managing and Operating ICT Effectively.

The key findings related to the validity and reliability of the ICT Usage Survey are summarised below.

- Overall, the expert review panel affirmed the content validity of the six-scale, 36-item survey. The panel suggested simplifying the language of

some items to improve the readability of the survey for primary school-aged children. For example, additional information was added to one item to explain what acknowledging a source meant.

- The student pilot study (involving six students) also generally supported the face validity of a six-scale, 36-item survey using a five-point frequency response scale of *almost never, rarely, sometimes, often* and *almost always*. Student feedback confirmed the readability of the survey and students' understanding of the response scale.
- Based on the data from the sample of 574 students in 31 classes, one scale (Creating with ICT) was omitted after principal axis factoring with oblique rotation as it did not meet the retention criteria. The factor analysis results supported the validity of a 29-item, five-scale ICT Usage Survey. For the remaining five scales, each item had a factor loading of at least .40 on its *a priori* scale and less than .40 on all other scales, with the exception of two items from the same scale (Managing and Operating ICT Effectively), which were, nonetheless, retained to strengthen the overall reliability of the scale. The eigenvalues for all scales were above 1 and the total proportion of variance accounted for was high (at 64.35%), all of which satisfied Kaiser's (1960) recommendation that the eigenvalue for a factor should be greater than 1.
- The internal consistency reliability coefficients for each of the remaining five ICT Usage Survey scales were calculated using Cronbach's alpha for both the individual and the class mean as units of analysis. The alpha reliability estimates ranged from .81 to .91 (individual) and .88 to .97 (class). Given that these values were above .70, according to the criteria suggested by Cohen et al. (2011), the internal consistency of each scale was supported.
- The correlation matrix from the oblique rotation indicated that all five ICT scales were distinct, with the highest correlation between any two scales being .44, thus supporting the discriminant validity of the ICT Usage Survey.
- The ANOVA results indicated that all five scales of the ICT Usage Survey were able to differentiate statistically significantly ($p < .01$) between the

perceptions of students in different classes, thus providing evidence to support concurrent validity.

- The simple correlation results indicated that all five scales were statistically significantly ($p < .01$) correlated with the outcome of Enjoyment of ICT. This finding supported the predictive validity of the ICT Usage Survey.

The evidence reported above strongly supported the validity and reliability of the modified ICT Usage Survey for use with Australian primary school students. To the best of the researcher's knowledge, no similar surveys previously existed that were designed to assess primary school students' perceptions of the use of ICT within their learning environment. As such, the development and validation of the ICT Usage Survey provides a unique contribution to learning environments research.

The ICT Usage Survey includes two notable features. First, the survey scales are closely aligned with the elements of the ICT General Capability within the Australian Curriculum (ACARA, n.d.), which may be useful in allowing Australian teachers to assess the extent to which they are implementing this curriculum capability (based on the perceptions of their students). Second, the survey has been designed to be readable for primary school-aged respondents, supporting the suitability of the survey for use in the Australian primary school context.

As with the CCQ-P, the ICT Usage Survey has been implemented only in the present study, with students in Western Australian Catholic schools. Therefore, to further examine the validity and reliability of the survey, it is recommended that future research involves a more diverse student sample (*Recommendation 1b*).

6.2.1.3 Validity and Reliability of the Self-Efficacy and Enjoyment Questionnaire (SEEQ)

The SEEQ was developed to assess students' self-efficacy, enjoyment of their class, and enjoyment of using ICT. The SEEQ is comprised of three scales: Self-Efficacy, Enjoyment of Class, and Enjoyment of ICT. Each scale was comprised of 5 items, providing 15 items in total.

The key findings related to the validity and reliability of the SEEQ are summarised below.

- Overall, the expert review panel and student pilot study affirmed the content and face validity of a three-scale, 15-item survey using a five-point frequency response scale of *almost never*, *rarely*, *sometimes*, *often* and *almost always*.
- The 15-item, five-scale SEEQ displayed strong factorial validity for both the actual and preferred versions. Each item had a factor loading of at least .40 on its a priori scale and less than .40 on all other scales. The eigenvalues for all scales were above 1 and the total proportion of variance accounted for was high (at 68.71%), all of which satisfied Kaiser's (1960) recommendation that the eigenvalue for a factor should be greater than 1.
- The internal consistency reliability coefficients for each of the three SEEQ scales, calculated using Cronbach's alpha, were high. Using the individual as the unit of analysis, the alpha coefficients for the different scales ranged from .82 to .92. Using the class mean as the unit of analysis, the alpha coefficients ranged from .84 to .97. Given that these alpha reliability estimates were above .70, according to the criteria recommended by Cohen et al. (2011), the internal consistency of each scale was supported.
- The correlation matrix, obtained through oblique rotation, indicated that all three SEEQ scales were distinct, with the highest correlation between any two scales being .43, thus supporting the discriminant validity of the SEEQ.
- The ANOVA results for the SEEQ scales indicated that two of the three scales (Enjoyment of Class and Enjoyment of ICT) differentiated statistically significantly between the perceptions of students in different classes ($p < .01$), whereas the Self-Efficacy scale did not. Overall, the results provided evidence to suggest concurrent validity of the SEEQ scales.

The evidence outlined above strongly supports the validity and reliability of the SEEQ for use with primary school students. The validation of the SEEQ fills a gap in current research as, previously, no validated instruments existed that were suitable for assessing primary school students' self-reports of self-efficacy, enjoyment of class, or

enjoyment of using ICT within their learning environment. Therefore, the development and validation of the SEEQ constitute a unique contribution to learning environments research.

The validity results obtained in this study in terms of the validity of the SEEQ are comparable with past research involving the validation of similar surveys for the secondary school level (see, for example, the ASBS by Bell and Aldridge, 2014, reported in Section 4.4 of Chapter 4). As with the other two surveys, the SEEQ only has been implemented in the present study, with students in Western Australian Catholic schools. Therefore, to further examine the validity and reliability of the survey, it is recommended that future research involves more diverse student samples (*Recommendation 1c*).

This section (Section 6.2.1) has summarised and discussed results related to the validation of the three surveys study (the CCQ-P, ICT Usage Survey, and the SEEQ) developed for the purposes of the present study (research objective 1). The following section (Section 6.2.2) summarises and discusses results related to the differences between primary school students' actual and preferred perceptions in relation to the learning environment and their use of ICT in the classroom.

6.2.2 *Actual and Preferred Differences*

The second research objective of the present study was:

To examine the actual–preferred differences reported by primary school students in terms of their:

- a) Perceptions of the learning environment; and
- b) Use of ICT.

Two of the newly developed instruments examined students' actual and preferred perceptions: the CCQ-P (in all scales) and the ICT Usage Survey (in the Investigating with ICT and Communicating with ICT scales only). The data collected from the matched sample of 574 students in 31 classes were analysed to examine the differences

between students' actual and preferred perceptions of their learning environment as well as of their ICT use within the classroom.

This section summarises and discusses the results related to students' actual–preferred differences. These results are summarised separately in relation to the learning environment (using the results of the CCQ-P; Section 6.2.2.1) and the use of ICT in the classroom (using the results of the ICT Usage Survey; Section 6.2.2.2).

6.2.2.1 Actual–Preferred Differences in Students' Perceptions of their Learning Environments

The key findings for the actual–preferred differences in students' perceptions of their learning environment are summarised below.

- The average item means were higher for students' preferred responses than for their actual responses for all CCQ-P scales except Task Orientation. These results indicate that, with the exception of Task Orientation, students would prefer each aspect of their learning environment to be more positive than they currently perceive it to be.
- The MANOVA results yielded statistically significant results ($p < .01$), using Wilks' Lambda criterion (Wilks, 1935). Therefore, the univariate ANOVA was interpreted for the individual CCQ-P scales. The results indicated that there were statistically significant ($p < .01$) differences between the actual and preferred scores for all nine CCQ-P scales.
- The magnitude of the differences between the actual and preferred means for two scales (Responsibility for Learning and Task Orientation) indicated effect sizes below .40. However, effect sizes for the remaining seven scales (Student Cohesiveness, Teacher Support, Equity, Task Clarity, Involvement, Personal Relevance and Collaboration) ranged from 0.45 to 0.65 standard deviations, indicating medium effects that are of practical significance, according to Cohen's (2013) criteria.

The results of the present study largely replicate those of numerous studies throughout the world that have found that students prefer a learning environment that is more

favourable than the one that is actually perceived to be present (see, for example, Aldridge et al., 2009; Aldridge, Fraser, et al., 2012; Dorman, 2008a, 2008b; Dorman & Fraser, 2004; Henderson et al., 2000; Koul et al., 2011; Lai et al., 2015; Magen-Nagar & Steinberger, 2017; Rekha et al., 2011; Rita & Martin-Dunlop, 2011; Wong et al., 2006). The results of the present study suggest that students would prefer to experience the constructs captured by eight of the nine CCQ-P scales (Student Cohesiveness, Teacher Support, Equity, Task Clarity, Responsibility for Learning, Involvement, Personal Relevance, and Collaboration) more frequently than they currently do.

For the exception, Task Orientation, the average item mean was lower for students' preferred perceptions (average item mean = 4.28) than for their actual perceptions (average item mean = 4.41). This result contradicts the results seen when other learning environments surveys have been implemented at both primary and secondary school levels, as students have tended to prefer a higher level of task orientation than currently exists (see, for example, Aldridge et al., 2009; Dorman, 2008a, 2008b; Rekha et al., 2011; Rita & Martin-Dunlop, 2011). Given that past research has indicated that students need to be clear about the assigned task and be motivated to complete the task (Killen, 2000; Spady, 1994), the result for Task Orientation in the present study is difficult to understand. The data collected for the present study did not provide causal explanations for the findings, and it is acknowledged that the inclusion of qualitative data (as recommended by Tran, 2016) could offer a means of exploring the reasons for these findings. It is recommended, therefore, that future research involve a mixed-method approach to allow deeper insights and explanations into the relationships between the factors and to provide causal explanations for this irregular result (*Recommendation 2*). Section 6.3.1.1 discusses the educational implications of the present study's findings that students preferred a learning environment more favourable than the one that was actually perceived to be present.

6.2.2.2 *Actual–Preferred Differences for ICT Use*

This section examines the results related to the actual–preferred differences in students' perceptions of ICT use within their learning environment. The key findings in this respect, based on the ICT Usage Survey data, are summarised below.

- For both of the scales that examined actual and preferred perceptions (Investigating with ICT and Communicating with ICT), students provided higher preferred responses than actual responses, suggesting that students would prefer a higher level of each type of ICT use than they currently perceive to be present.
- The MANOVA results yielded statistically significant results ($p < .01$), using Wilks' Lambda criterion (Wilks, 1935). Therefore, the univariate ANOVA was interpreted for the individual ICT scales. The results indicated that there were statistically significant ($p < .01$) differences between the actual and preferred scores for both scales.
- The effect sizes for both the Investigating with ICT scale (effect size = 0.53 standard deviations) and the Communicating with ICT (effect size = 0.70 standard deviations) were greater than 0.40 standard deviations. These results suggest that these aspects are large in effect and of practical significance, according to Cohen's (2013) criteria.

The results summarised above corroborate numerous prior studies involving actual–preferred responses that have found that, generally, students report more favourable scores for their preferred learning environment than for what they actually perceive to be present (Aldridge et al., 2009; Aldridge, Fraser, et al., 2012; Dorman, 2008a, 2008b; Henderson et al., 2000; Lai et al., 2015; Rekha et al., 2011; Rita & Martin-Dunlop, 2011). Research by Trinidad et al. (2005) suggests that this trend is also reflected in terms of learning environments that incorporate the use of ICT. In this present study, the results suggest that students prefer more use of ICT to investigate and communicate than they perceive to be present in their current classroom environment. This finding is supported by Wong et al. (2006), whose research suggests that students look favourably on the use of technology within the learning environment. Section 6.3.1.2 discusses the educational implications of the present study's findings that students preferred a greater use of ICT within the classroom than that was actually perceived to be present.

This section (Section 6.2.2) has summarised and discussed results related to students' actual–preferred perceptual differences in relation to both the learning environment and their use of ICT in the classroom (research objective 2). The following section

(Section 6.2.3) summarises and discusses results related to the learning environment and student outcome associations examined in the present study (research objective 3).

6.2.3 Associations Between the Learning Environment and Student Affective Outcomes

The third research objective of the present study was:

To examine the relationships between primary school students' perceptions of the learning environment and their self-reports of:

- a) Self-efficacy;
- b) Enjoyment of their class; and
- c) Enjoyment of using ICT.

This section (Section 6.2.3) discusses and summarises the results of the learning environment–outcome associations examined in the present study. The results are summarised separately for the outcome scales of Self-Efficacy (Section 6.2.3.1), Enjoyment of Class (Section 6.2.3.2), and Enjoyment of ICT (Section 6.2.3.3).

6.2.3.1 Self-Efficacy

The key findings related to the relationships between students' perceptions of the learning environment and their self-efficacy are summarised below.

- The simple correlation results suggested that statistically significant ($p < .01$) and positive relationships existed between all nine scales of the CCQ-P and self-efficacy.
- The multiple correlation (R) between the nine learning environment scales and the Self-Efficacy scale was .70 and statistically significant ($p < .01$), suggesting positive associations between the CCQ-P scales and students' self-efficacy. Analysis of the regression coefficients (β) revealed that five of the nine learning environment scales were statistically significantly and

positively related to self-efficacy: Student Cohesiveness ($\beta = 0.10, p < .01$), Task Clarity ($\beta = 0.34, p < .01$), Involvement ($\beta = 0.29, p < .01$), Task Orientation ($\beta = 0.25, p < .01$), and Collaboration ($\beta = 0.11, p < .05$).

Overall, these results indicate that students' perceptions of their classroom environment impact positively on their feelings of self-efficacy. That is, the more positively that students perceive these aspects of the learning environment, the greater the level of self-efficacy that they report. These results support much past research, which has provided evidence to suggest that the learning environment is strong determinant of student self-efficacy (Aldridge, Afari, et al., 2012; Chionh & Fraser, 2009; Dorman, 2001; Dorman & Fraser, 2009; Fraser, 2007, 2012c; Koul et al., 2011; Walker, 2006).

The results of the present research indicated that the three scales that had the highest statistically significant and positive correlations with the outcome of self-efficacy were Task Clarity, Task Orientation, and Involvement. In terms of task clarity, these results suggest that, when students understand the instructions of the task and know how to successfully complete the task, they feel a sense of self-belief in their own capabilities. This finding supports research by Wiliam (2005).

In terms of task orientation, the results reported above suggest that students experience a greater sense of self-efficacy when they understand the goal of a task and the importance of completing the task. This result is supported by past research by Bandura (1977) and Lopez (2012). Similarly, several studies utilising learning environment surveys have found statistically significant and positive associations between task orientation and student self-efficacy (Al Zubaidi et al., 2016; Bell, 2013; Chionh & Fraser, 2009; Dorman, 2001; Dorman & Fraser, 2009; Koul et al., 2011; Velayutham & Aldridge, 2013).

One of the highest statistically significant and positive correlations with the outcome of self-efficacy was the Involvement scale. This finding suggests that students experience greater feelings of self-efficacy when they perceive that they have opportunities to actively participate in the learning process. Other researchers studying learning environments at the secondary school level have similarly found positive and

statistically significant associations between students' perceptions of involvement in their learning and their levels of self-efficacy (Al Zubaidi et al., 2016; Bell, 2013; Chionh & Fraser, 2009; Dorman, 2001; Dorman & Fraser, 2009; Koul et al., 2011; Velayutham & Aldridge, 2013). Section 6.3.2.1 discusses the educational implications of the present study's findings that task clarity, task orientation and involvement were positively and statistically significantly associated with students' self-efficacy.

6.2.3.2 *Enjoyment of Class*

In addition to examining the relationships between the learning environment and students' self-efficacy, relationships were also examined between the learning environment and students' enjoyment of class. The key findings in this respect are summarised below.

- The simple correlation analysis suggested that, with one exception, statistically significant ($p < .05$) and positive relationships existed between all nine scales of the CCQ-P and students' enjoyment of class. The exception was Student Cohesiveness, for which the relationship was positive but not statistically significant.
- The multiple correlation (R) between the nine learning environment scales and the Enjoyment of Class scale was .69 and statistically significant ($p < .01$), suggesting positive associations between the CCQ-P scales and students' enjoyment of class. The regression coefficients (β) revealed that three of the nine CCQ-P scales were statistically significantly ($p < 0.01$) and positively related to students' enjoyment of class: Teacher Support ($\beta = .18$), Personal Relevance ($\beta = .26$), and Collaboration ($\beta = .16$).

Overall, these results indicate that students' perceptions of their classroom environment positively impact on their feelings of enjoyment of their class. In particular, more teacher support, personal relevance, and collaboration within the learning environment positively affected students' enjoyment of class. These findings support past research at the secondary school level that indicates that the learning environment is a strong predictor of enjoyment (Aldridge & Fraser, 2008; Aldridge, Fraser, et al., 2012; Chionh & Fraser, 2009; Dorman & Fraser, 2009; Fraser, 2007,

2012c; Fraser et al., 2010; Koul et al., 2011; Ogbuehi & Fraser, 2007; Walker, 2006; Wong & Fraser, 1996).

The results of the present study suggest that students' enjoyment of their class is affected by the extent to which they perceive to be supported by their teacher. Teacher support may include encouraging and assisting students with their work as well as showing interest in the student and care for their well-being. Interestingly, Strati et al. (2017) claim that teachers' instructional support for students (helping students with academic tasks) is more strongly correlated with student enjoyment and engagement than teachers' emotional support for students. According to Bell (2013), relationships between teachers and students are a crucial aspect of the classroom environment that can affect students' enjoyment of learning. This position is supported by several studies at the secondary school level that have identified positive and statistically significant relationships between teacher support and student enjoyment of learning within the classroom (Bell, 2013; Chionh & Fraser, 2009; Dorman & Fraser, 2009; Fraser et al., 2010; Koul et al., 2011; Petegem, Aelterman, Rosseel, & Creemers, 2007; Strati et al., 2017; Wolf & Fraser, 2008). The findings of the afore mentioned studies suggest that students' perceptions of the extent to which their teacher relates to them, shows interest in them, and assists them to learn have a significant impact on their enjoyment of class.

In terms of relevance, the results of the present study suggest that the relevance of students' learning impacts on their enjoyment of class. That is, when students perceive that their learning is applicable to and meaningful for their daily lives, they report greater of enjoyment of class. These results align with past research at the secondary school level which suggest that the relevance of lesson content is linked to student enjoyment (Aldridge, Fraser, et al., 2012; Fraser, 1998b; Ogbuehi & Fraser, 2007; Ryan & Deci, 2000; Taylor et al., 1997). According to Bell (2013), teaching relevant content allows teachers to establish meaningful contexts to build on students' prior knowledge and teach new concepts.

In terms of collaboration, the results of the present study indicated that the degree of opportunities for students to collaborate was statistically significantly and positively related to students' enjoyment of class, suggesting that students find their class more

enjoyable when they have opportunities to collaborate with their peers. This finding is supported by the results of several past studies conducted at secondary and tertiary education levels that found positive and statistically significant associations between student collaboration and enjoyment of class or subject (Chionh & Fraser, 2009; Dorman & Fraser, 2009; Johnson et al., 2007; Mohammad-Davoudi & Parpouchi, 2016; Slavin, 2010; Tan, Sharan, & Lee, 2007). Conversely, Koul et al. (2011) and Wolf and Fraser (2008) found that collaboration was statistically significantly and negatively related to enjoyment, and qualitative data in Wolf and Fraser's (2008) study indicated that some students felt that group work resulted in one student doing most of the work, resulting in frustration and less positive attitudes toward the class. Section 6.3.2.2 discusses the educational implications of the present study's findings that teacher support, personal relevance, and collaboration were positively and statistically significantly associated with students' enjoyment of class.

6.2.3.3 *Enjoyment of ICT*

This section summarises and discusses the associations between students' perceptions of their learning environment and their self-reports of enjoyment of using ICT. The key findings in this respect are summarised below.

- The results of the simple correlation suggested that statistically significant ($p < .01$) and positive relationships existed between all nine learning environment scales and students' enjoyment of ICT.
- The multiple correlation (R) between the nine learning environment scales and the Enjoyment of ICT scale was .41 and statistically significant ($p < .01$), indicating that there were positive associations between the CCQ-P scales and enjoyment of ICT. The regression coefficients (β) revealed that three of the nine CCQ-P scales—Task Orientation ($\beta = .12$, $p < 0.05$), Personal Relevance ($\beta = .22$, $p < 0.01$), and Collaboration ($\beta = .13$, $p < 0.05$)—were statistically significantly and positively related to enjoyment of ICT.

Overall, these results indicate that students' perceptions of their classroom environment impact positively on their enjoyment of using ICT. In particular, task

orientation, personal relevance, and collaboration within the learning environment positively impact on students' enjoyment of using digital technologies. This suggests that, when using ICT, students' perceptions of the extent to which they have a clear understanding of their work, feel their learning is relevant to them, and have opportunities to collaborate with their peers have significant impacts on their enjoyment of ICT within the classroom environment. Few studies were found to exist in this area, thus the present study makes an important contribute to this field of research. The results of the few studies that were found to examine the relationships between the learning environment and students' enjoyment of using ICT supported the findings of the present study. For example, in relation to relevance, Mitev and Crowther (2008), identified that one of the benefits of using ICT in the classroom lies in its ability to provide real-world contexts for learning, thus altering the transfer of knowledge from an abstract process to a more relevant contextualised process. In relation to task orientation and collaboration, Dorman & Fraser (2009) found statistically significant and positive relationships between the learning environment and students' enjoyment of using ICT, including confirming the importance of task orientation and opportunities for collaboration among students. Section 6.3.2.3 discusses the educational implications of the present study's findings that task orientation, personal relevance, and collaboration were positively and statistically significantly associated with students' enjoyment of using ICT.

This section (Section 6.2.3) has discussed and summarised results related to the learning environment–outcome associations (self-efficacy, enjoyment of class, and enjoyment of using ICT) examined in the present study (research objective 3). The following section (Section 6.2.4) discusses and summarises the relationships between the use of ICT in the classroom and the affective outcomes of student self-efficacy, enjoyment of class, and enjoyment of using ICT (research objective 4.)

6.2.4 Associations Between the Use of ICT and Student Affective Outcomes

The fourth research objective of the present study was:

To examine the relationships between primary school students' perceptions of their use of ICT and their self-reports of:

- a) Self-efficacy;
- b) Enjoyment of their class; and
- c) Enjoyment of using ICT.

As with the previous research question (see Section 6.2.3), to examine the relationships between students' perceptions of the use of technology and the student outcomes simple correlation and multiple regression analysis (R) were used. This section summarises and discusses the results of the present study in terms of the relationships between the use of ICT in the classroom and the three affective student outcomes.

6.2.4.1 ICT Usage–Outcome Associations

The key findings of this study in terms of the associations between student perceptions of the use of ICT and their self-reports of self-efficacy, enjoyment of class, and enjoyment of using ICT are summarised below.

- The simple correlation analysis indicated that statistically significant ($p < .01$) and positive relationships existed between all five scales of the ICT Usage Survey and all three affective outcomes (self-efficacy, enjoyment of class, and enjoyment of using ICT).
- The multiple correlation (R) between the five scales of the ICT Usage Survey and the Self-Efficacy scale was .29 and statistically significant ($p < .01$), suggesting positive associations between the ICT scales and students' self-efficacy. The regression coefficients (β) indicated that all five of the ICT Usage Survey scales were positively related to self-efficacy;

however, only the contribution of the Changing Trends scale ($\beta = 0.12$, $p < .05$) was statistically significant.

- The multiple correlation (R) between the five ICT Usage Survey scales and the Enjoyment of Class scale was .45 and statistically significant ($p < .01$). The standardised regression coefficients (β) indicated that two of the five ICT Usage Survey scales were statistically significantly and positively related to students' enjoyment of class: Investigating with ICT ($\beta = 0.37$, $p < .01$) and Applying Social and Ethical Protocols and Practices ($\beta = 0.11$, $p < .05$).
- The multiple correlation (R) for the five ICT Usage Survey scales and the Enjoyment of Class scale was .53 and statistically significant ($p < .01$). The standardised regression coefficients (β) indicated that two of the five ICT Usage Survey scales were statistically significantly ($p < .01$) and positively related to students' enjoyment of ICT: Investigating with ICT ($\beta = 0.12$) and Changing Trends ($\beta = 0.47$).

The positive and statistically significant relationship between students' perceptions of the Changing Trends scale suggests that the use of ICT may have impacted on the types of tasks that students do, thereby enhancing students' experiences of these tasks. That is, the ways in which ICT has enabled students to work differently make them feel more confident in their abilities to complete tasks successfully. This interpretation is supported by Dorman and Fraser (2009), Koul et al. (2011), and Tomte and Hatlevik (2011), all of whom have reported positive associations between the use of ICT in the secondary school learning environment and students' self-efficacy. Research by Aesaert and van Braak (2014) found that similar associations existed at a primary school level. Section 6.3.3 discusses the educational implications of the present study's findings that students' perceptions of their use of ICT in the classroom impact positively on their feelings of self-efficacy.

The second outcome that was examined in relation to students' ICT use was students' enjoyment of their class. The results suggest that Investigating with ICT and Applying Social and Ethical Protocols and Practices positively impacted on students' enjoyment of class. These findings indicate that the impact of ICT use on students' enjoyment of a class may be dependent upon the extent to which the students use ICT to search for

and evaluate information and are able to use ICT in an ethical and socially responsible manner. This finding is supported by Koul et al. (2011) and Dorman and Fraser (2009), who found that computer usage in secondary school classrooms was statistically significantly and positively related to a range of student attitudes (including their enjoyment of a subject).

The results indicate that using ICT to investigate and to complete tasks in new ways positively impact on students' enjoyment of ICT. These results are supported by Dorman and Fraser (2009), Fraillon et al. (2014) and Koul et al. (2011), whose research identified positive correlations between secondary school students' computer use and a range of attitudes (including enjoyment) towards the use of ICT. The findings of the present study suggest that, with respect to ICT use, students' enjoyment of using ICT is determined to the greatest degree by the extent to which students search for and evaluate information with technology. Results of the present study also suggests that the ways in which ICT has impacted on the types of learning tasks that students do may have enhanced students' experience, which may have subsequently impacted on their enjoyment of ICT. That is, students enjoy the ways in which ICT has enabled them to work differently in class. Section 6.3.3 discusses the educational implications of the present study's findings that students' perceptions of their level of use of ICT in the classroom impact positively on affective outcomes.

This section (Section 6.2.4) has discussed and summarised the results of the relationships between the use of ICT in the classroom and the three affective student outcomes of self-efficacy, enjoyment of class, and enjoyment of using ICT (research objective 4). The following section (Section 6.2.5) summarises and discusses the differences in students' perceptions and outcomes according to student gender (research objective 5).

6.2.5 Differences in Students' Perceptions and Outcomes According to Gender

Of concern for teachers is ensuring that both males and females are equitably catered for in the classroom environment. Therefore, the fifth research objective was:

To examine whether learning environment perceptions and outcomes (in terms of self-efficacy and enjoyment) differ for primary school students of different genders.

Analysis for this objective involved data from 283 males and 291 females. Given that the numbers of male and female students were unequal, the class mean ($N=31$) for male and female students was considered to be the appropriate unit of analysis. To examine the differences, a one-way MANOVA was used with the scales of each survey as the dependent variables and student gender as the independent variable. As the multivariate test using Wilk's lambda criterion indicated the presence of statistically significant differences, the univariate one-way ANOVA was interpreted for each scale. In addition, effect sizes were calculated to determine the magnitude of the differences between the scores according to gender.

The following sections examine the differences in students' perceptions according to gender. These results are summarised and discussed separately in relation to gender differences in learning environment perceptions (Section 6.2.5.1); ICT usage (Section 6.2.5.2); and self-efficacy, enjoyment of class, and enjoyment of ICT use (Section 6.2.5.3).

6.2.5.1 Gender Differences in Learning Environment Perceptions

Key results related to the differences in male and female students' perceptions of their learning environment are summarised below.

- MANOVA results indicated that differences between the scores reported by males and females were statistically significant for five of the nine learning environment scales: Teacher Support ($p < .05$), Equity ($p < .05$), Task Clarity ($p < .05$), Responsibility for Learning ($p < .05$), and Task Orientation ($p < .01$). In all five cases, females scored higher than males.
- The effect sizes for those scales with a statistically significant difference ranged from 0.19 standard deviations (for Responsibility for Learning) to 0.35 standard deviations (for Task Orientation), indicating a small effect, according to Cohen's (2013) criteria.

The results, summarised above, indicated that female students scored higher means than males in all scales, with one exception (the Personal Relevance scale), suggesting that females perceive the learning environment to be more positive than males do. This finding is consistent with previous research, conducted around the world at different education levels, that has found similar trends. At the high school level, studies have found that, in general, female students perceive the same classroom environment more positively than males in Australia (Aldridge & Fraser, 2008; Chipangura & Aldridge, 2017; Dorman, 2008b; Dorman & Fraser, 2009; Fraser et al., 2010); Bhutan (Tshewang et al., 2017); Brunei Darussalam (Majeed et al., 2002); Canada (Klassen, 2010); Indonesia (Fraser et al., 2010; Wahyudi & Treagust, 2004); the Netherlands (den Brok et al., 2006); Oman (Alkharusi et al., 2014); and Turkey (Boz et al., 2016). At the tertiary level, the results of a study conducted in Turkey by Kaya et al. (2008) using the Teacher Communication Behaviour Questionnaire (She & Fisher, 2000) also suggested that female students reported more positive perceptions of the same learning environment than male students did. Similarly, at the primary school level, a study conducted in Singapore by Goh and Fraser (1998) found that female students viewed the learning environment more favourably than male students.

Despite these interesting and statistically significant findings, the lack of qualitative data makes it difficult to interpret these findings—it is recommended, therefore, that future research is conducted to further examine the differences in perceptions between male and female primary school students (*Recommendation 3*). Including qualitative data in such research would be beneficial in terms of examining whether the more positive perceptions of female students due to higher innate levels of positivity or whether learning environments are, in fact, more suited to female students. Section 6.3.4 discusses the educational implications of the present study's findings that female students tend to perceive the learning environment more positively than male students.

6.2.5.2 Gender Differences in ICT Usage Perceptions

Data collected from the ICT Usage Survey (using the sample of 574 students in 31 classes) were analysed to examine the differences in male and female students' perceptions of their ICT use in the classroom. Key results are summarised below.

- The MANOVA results indicated that the difference between the male and female students' scores was statistically significant ($p < .05$) for only one scale, namely, Communicating with ICT.
- The effect size for this scale was 0.23 standard deviations, indicating a small effect according to Cohen's (2013) criteria.

These results indicate that, with the exception of one scale (Communicating with ICT), the perceptions of male and female students in relation to their current use of ICT within the classroom were similar. For the scale for which there was a statistically significant difference between the scores, the Communicating with ICT scale, females reported higher scores than their male counterparts did. This finding may indicate that females perceive that they use ICT to communicate more often than males do. Despite the statistically significant difference between male and female students' perceptions of the use of ICT to communicate within the classroom, there was only a small effect size. It is interesting to note that, overall, students scored lower for this scale when compared to the other ICT usage scales, suggesting that, despite the gender difference, communicating with ICT did not occur often in these primary school classrooms.

The results of previous research into gender perception differences in relation to the use of ICT in the classroom have been mixed. Research by Bolliger and Supanakorn (2011) and Schroeder and Adesope (2015) found no gender differences to exist in student perceptions of the use of ICT in the classroom. Whereas studies by Dorman & Fraser (2009), Snell (2012), and Wehrwein et al. (2007) all found that males had higher mean responses in relation to using technology in the classroom which contradicts the results of the present study. Given the mixed results between the present study and previous research, it is recommended that further research is conducted into the preferences of male and female students in relation to ICT use in the classroom and into how teachers can integrate the use of technology to cater for differing learning preferences according to gender (*Recommendation 4*).

6.2.5.3 *Gender Differences in Affective Outcomes*

Data collected from the matched sample of 574 students in 31 classes were analysed to examine the differences in male and female students' self-reports of self-efficacy,

enjoyment of class, and enjoyment of using ICT in the classroom. The results are summarised below.

- The results of the MANOVA indicated that the differences between the scores of males and females were statistically significant ($p < .01$) for only the Self-Efficacy scale.
- The effect size for this scale was 0.29 standard deviations, which is considered to be modest in effect according to Cohen's (2013) criteria.

These findings indicated that the only statistically significant difference in students' outcomes was for self-efficacy, with females reporting higher levels of self-efficacy than their male counterparts. This finding suggests that female students experience more favourable outcomes than male students in terms of their confidence and belief in their own ability to successfully perform learning tasks. This result is similar to the findings of research carried out at the secondary school level by Finn and Rock (1997) and Pastorelli et al. (2001), who reported that female students have higher self-reports of self-efficacy than male students. However, Dorman and Fraser (2009) found the opposite to be true for secondary school students, as did Phan (2011) at the tertiary level. According to Huang (2013), gender differences in efficacy at the secondary school level vary according to the academic subject, with male students reporting higher levels of self-efficacy in mathematics and female students reporting higher self-efficacy in the language arts. Given that no past studies could be found that examined self-efficacy according to gender at the primary school level, it is recommended that further research is conducted into gender differences in primary school students' self-efficacy beliefs. (*Recommendation 5*).

The results of the present study suggested that no statistically significant differences existed in relation to male and female students' self-reports of either enjoyment of class or enjoyment of using ICT. These results are in contrast to the results of a study by Dorman and Fraser (2009), who found that male students reported higher levels of enjoyment of using ICT, whereas female students reported higher levels of enjoyment of academic subject. No similar previous studies were found that had been conducted at a primary school level. As such, it is recommended that further research is conducted into gender differences in students' enjoyment (both of class and of ICT

use) at the primary school level. Such research could seek to clarify whether the lack of gender differences in these perceptions at the primary school level (as observed in the present study) is typical and whether enjoyment levels alter in gender-related ways as students move to secondary school (*Recommendation 6*).

This section (Section 6.2.5) has discussed and summarised the differences according to gender in students' perceptions and outcomes examined in the present research (research objective 5). The following section (Section 6.2.6) discusses and summarises similar differences in the case of at-risk students and students who were not considered to be at-risk (research objective 6).

6.2.6 Differences in the Perceptions and Outcomes According to Risk Status

A concern for teachers is how to create a learning environment that caters to all students, particularly those who are academically at risk. Therefore, the sixth research objective in the present study was:

To examine whether learning environment perceptions and outcomes (in terms of self-efficacy and enjoyment) differ for primary school students who are at risk compared to those who are not at risk.

Analysis involved the data from the matched sample of 574 students in 31 classes. Of these students, 170 were considered to be academically at risk and the remaining 404 students were not at risk. Given that the number of students who were considered to be at risk differed to those who were considered to be not at risk, the class mean for each category of student was used as the unit of analysis.

To examine whether the differences in students' scores were statistically significant, MANOVA was used with the scales of each instrument (the CCQ-P, the ICT Usage Survey, and the SEEQ, respectively) as the dependent variables and the student's risk status (at risk or not at risk) as the independent variable. As the multivariate test using Wilk's lambda criterion showed that statistically significant differences were present for each of the three surveys, the univariate one-way ANOVA was interpreted for each scale. To examine the magnitude of the differences, effect sizes were calculated.

This section discusses and summarises the differences in the perceptions and outcomes of at-risk students compared to students who were not considered to be at risk. The results are summarised separately for differences in students' perceptions of the learning environment (Section 6.2.6.1); perceptions of ICT usage (Section 6.2.6.2); and self-efficacy, enjoyment of class, and enjoyment of ICT outcomes (Section 6.2.6.3).

6.2.6.1 Risk Status Differences in Learning Environment Perceptions

The key findings related to the differences in learning environment perceptions for academically at-risk students and not-at-risk students are summarised below.

- The average item means indicated that, for all nine learning environment scales, students who were considered to be at risk reported lower scores than not-at-risk students.
- In terms of the ability to determine whether there were statistically significant differences between at-risk and not-at-risk students' perceptions of their learning environment, the ANOVA results indicated that there were statistically significant differences ($p < .05$) between the two groups of students' perceptions for four of the nine learning environment scales: Equity, Task Clarity, Responsibility for Learning, and Task Orientation.
- The effect sizes ranged between 0.57 and 1.04 standard deviations for those scales for which the difference was statistically significant. According to Cohen's (2013) criteria, these differences range from medium (above 0.50 standard deviations) to large (above 0.80 standard deviations) in effect.

Although some studies exist that focus on *teachers'* perceptions of at-risk students (Hastings, Hewes, Lock, & Witting, 1996; Poulou, 2017), little research exists that focuses on the perceptions of at-risk students themselves (Klassen, 2010). The results of the present study, summarised above, indicate that students who were at risk perceived quite different learning environments to those who did not. In particular, they perceived the Equity, Task Clarity, Responsibility for Learning, and Task Orientation scales to occur less often than students who were not at risk did. The large

effect size suggests that these different perceptions between students who are at risk and those who are not at risk are educationally important.

In terms of the Equity scale, the results suggested that students who are at risk perceived that the learning environment less equitable than not-at-risk students did. This finding correlates with past studies that suggest that at-risk students participate less in learning activities (Finn & Rock, 1997; Finn et al., 1995; Lamborn et al., 1992) as well as studies that have indicated that if the content taught in lessons is beyond the capabilities of at-risk students, causing them to feel less able to participate in learning (for example, in class discussions), they, in turn, perceive classroom opportunities to be inequitable (Finn et al., 1995). In addition, research by Kavkler, Babuder, and Magajna (2015) suggests that at-risk students may experience a diverse range of issues, which are often complex and difficult to manage. As such, these students often integrate poorly into their social environment, which can result in inequitable learning opportunities. It is recommended, therefore, that further research is conducted to determine whether attempts by the teacher to support the learning of at-risk students (thereby involving the teacher treating at-risk students differently to their classmates) result in at-risk students perceiving the learning environment to be inequitable (*Recommendation 7*).

The results summarised above indicated that there was a statistically significant difference in students' perceptions of the Task Clarity scale, with the at-risk students reporting lower scores than their counterparts who were not at-risk did. This finding suggests that, compared to students who are not at risk, at-risk students in the present study had less clear understandings of the learning intentions for the assigned task and the expectations associated with completing the task successfully. Intuitively, this result appears to make sense, given that at-risk students generally find learning difficult, in part due to their difficulty in comprehending instructions about the task. The importance of task clarity for at-risk students is supported by numerous researchers who recommend that clear learning intentions be stated as part of the daily lesson structure and that clear and explicit instructions are necessary for learning to occur (Gagne, 1985; Hattie, 2012; Hollingsworth & Ybarra, 2009; McDonald, 2013; Westwood, 2004).

In terms of the Responsibility for Learning scale, the results summarised above indicated that there was a statistically significant difference with at-risk students reporting lower scores for this scale than their counterparts who are not at risk did. This finding suggests that, compared to their peers who are not at risk, at-risk students are less likely to be given opportunities to work independently and to take responsibility for their learning. This finding appears to be intuitively defensible due to the additional assistance that at-risk students are likely to receive from their teachers. This result is also similar to previous studies that have indicated that at-risk students reported reduced levels internal locus of control than their classmates (Finn & Rock, 1997; Westwood, 2004). That is, the at-risk students felt that they were less in control of (or responsible for) their own learning and their own destiny than students who were not at risk did. Westwood (2004) suggests that students who are at risk require opportunities to develop their self-regulatory skills and habits—that is, to think about their thought processes, to self-monitor their learning, and to modify their own learning strategies as required. Finn and Rock (1997) and Westwood (2004) further suggest that providing opportunities for at-risk students to feel more in control of (and responsible for) their own learning can result in increased levels of student engagement in learning. Although Westwood (2004) acknowledges that at-risk students require a lot of collaborative group work and teacher support to achieve their goals, Westwood nonetheless notes that these students also require some experiences of independent work.

In terms of Task Orientation, the results described above indicated that there was a statistically significant difference between the perceptions of academically at-risk students and not-at-risk students. As such, it would appear that academically at-risk students perceive that they are less focused on completing the assigned task than students who are not at-risk. This finding may be attributable to the phenomenon described by Westwood (2004), in which at-risk students would rather be perceived as having failed due to a lack of effort than a lack of ability. That is, these students would prefer not to put their focus and effort into a task at all rather than to try the task and subsequently fail. As such, at-risk students can have higher levels of task avoidance than their classmates (Westwood, 2004).

The difference between academically at-risk and not-at-risk students' perceptions of task orientation documented in the present study correlates with the finding by Taylor, Sternberg, and Richards (1995) that at-risk students tend to be less task oriented than students who are not at-risk are. Similarly, Westwood (2004) suggests that academically at-risk students can be more easily distracted from a task than students who are not at risk. Section 6.3.5.1 discusses the educational implications of the present study's findings that academically at-risk students perceived their learning environment less favourably than not-at-risk students did.

6.2.6.2 Risk Status Differences in ICT Usage Perceptions

The key findings for the differences in perceptions of ICT use for students above national minimum standard and at-risk students are summarised below.

- The average item means revealed that, for three of the five ICT Usage Survey scales (Investigating with ICT, Applying Social and Ethical Protocols and Practices, and Changing Trends), not-at-risk students reported a greater use of ICT within the classroom than at-risk students did.
- The MANOVA results indicated that the differences were statistically significant ($p < .05$) for two of the ICT Usage Survey scales: Applying Social and Ethical Protocols and Practices ($p < .01$) and Changing Trends ($p < .05$). The effect sizes for these two scales were 0.34 and 0.22 standard deviations, respectively; according to Cohen's (2013) criteria, these differences were small in effect. For both of these scales, the average item means for at-risk students were lower than those for not-at-risk students.

The results, summarised above, suggest that at-risk students perceive there to be less frequent opportunities to use ICT within the classroom than not-at-risk students did. Whilst the difference between at-risk and not-at-risk students was small in effect, this finding is of concern as the results of a meta-analysis by Swanson (1999) suggest that the use of computer-aided instruction to assist the learning of at-risk students has a moderate effect size of 0.52 according to Cohen's (2013) criteria. Given that computer-aided instruction assists the learning of at-risk students, and yet (in the present study) at-risk students reported less ICT usage than their not-at-risk

classmates, it is recommended that teachers pay attention to this difference and ensure that at-risk students have adequate opportunities to use ICT (*Recommendation 8*).

Of note in the results reported above was the higher average item mean for students who were not at risk (compared to at-risk students) for the Applying Social and Ethical Protocols and Practices scale. For this scale, the average item means for both groups of students were between 3 and 4, suggesting that both groups of students were reminded by their teacher to use ICT in an ethical manner between (only) *sometimes* and *often*. However, this scale demonstrated the greatest difference between the scores of the at-risk and not-at-risk students. As such, it appeared that the not-at-risk students perceived that they were reminded to use ICT ethically and in a socially appropriate manner more often than those who were at-risk.

That at-risk students perceived that they were reminded by their teacher to use ICT in an ethical manner less often than not-at-risk students is of concern. Although no previous research was found that examined either the perceptions of at-risk students in relation to ICT use in the classroom or the ethical and appropriate use of ICT, past research does highlight the importance of teaching students to use ICT ethically and appropriately and judiciously (Ahuja, 2016; Mitev & Crowther, 2008). The anonymity of communication permitted by the use of the internet can preclude normal societal disciplinary practices and surveillance mechanisms, making cyber safety an essential skill: Students need to be able to protect themselves from online bullying, fraud, and privacy violations (OECD, 2015). If at-risk students tend to have difficulties with social cues and other social, comprehension, and communication skills (as suggested by Westwood, 2004), it would seem reasonable that being reminded less often to apply social and ethical protocols when using ICT would leave these students even more vulnerable to the risks associated with ICT use (outlined above). Section 6.3.5.2 discusses the educational implications of the present study's findings that at-risk students perceive there to be less frequent opportunities to use ICT within the classroom than not-at-risk students did.

6.2.6.3 Risk Status Differences in Affective Outcomes

The key findings for the differences in the perceptions of self-efficacy, enjoyment of class, and enjoyment of using ICT in the classroom for students at-risk and not-at-risk students are summarised below.

- The average item means for the SEEQ scales indicated that, for all three scales, students who were not at risk had more positive self-reports of these affective outcomes than at-risk students did.
- The MANOVA results indicated that, for two of the three scales, differences in scores were statistically significant: Self-Efficacy ($p < .01$) and Enjoyment of Class ($p < .05$). The effect sizes for these two scales were 0.73 and 0.48 standard deviations, respectively. According to Cohen's (2013) criteria, the difference was large in effect for the Self-Efficacy scale and moderate in effect for the Enjoyment of Class scale.

The results outlined above suggest that at-risk students experience less favourable attitudes in relation to self-efficacy, enjoyment of class, and enjoyment of ICT than their not-at-risk classmates do. This section discusses the results of each affective outcome scale in turn.

The results of the present study suggest that academically at-risk students experience lower self-efficacy than students who are not at risk. This finding is not surprising given that it seems reasonable that academically at-risk students are more likely to experience difficulties in their learning than students who are not at-risk. This finding is consistent with past research that confirms that at-risk students may experience lower levels of self-efficacy (Baird et al., 2009; Klassen, 2010; Lackaye, Margalit, Ziv, & Ziman, 2006; Lumby, 2012; Westwood, 2004). Klassen (2010) and Westwood (2004) suggest that this phenomenon among at-risk students may be due to academic doubts resulting from these students' skill deficits.

The results of the present study also indicate that at-risk students experience less favourable attitudes in terms of enjoyment of class than not-at-risk students do. This finding is supported by Lumby (2012) and Milsom and Glanville (2010), who suggest

that at-risk students tend to report less positive affective outcomes, such as enjoyment, in relation to school. Frenzel et al. (2009), Lumby (2012) and Milsom and Glanville (2010) note that fostering positive student–teacher relationships is a vital aspect of enhancing enjoyment for such students. Section 6.3.5.3 discusses the educational implications of the present study’s findings that academically at-risk students’ experience less favourable attitudes in relation to self-efficacy, enjoyment of class, and enjoyment of ICT than not-at-risk students do.

This section (Section 6.2.6) has discussed and summarised the differences between academically at-risk and not-at-risk students’ learning environment perceptions and outcomes examined in the present research (research objective 6). Section 6.2 has discussed and summarised the findings of the present study in relation to research objectives 1 to 6. The following section (Section 6.3) discusses the educational implications of the findings that were outlined in this section.

6.3 Educational Implications

The results of the present study provide numerous insights for teachers regarding the perceptions of primary school students in relation to their learning environment and use of ICT as well as the students’ related outcomes of self-efficacy, enjoyment of their class, and enjoyment of using ICT. This section outlines the educational implications of these findings in terms of: differences in students’ actual and preferred perceptions (Section 6.3.1); associations between the learning environment and student outcomes (Section 6.3.2); associations between the use of ICT and student outcomes (Section 6.3.3); gender differences in student perceptions and outcomes (Section 6.3.4); and differences in perceptions and outcomes for those students who are at-risk and those who are not (Section 6.3.5).

6.3.1 *Educational Implications of Students’ Actual and Preferred Differences*

The results of the present study in terms of the differences between students’ actual and preferred perceptions (summarised in Section 6.2.2) offer several insights regarding how teachers can structure learning environments and use ICT to enhance

the perceptions of students. The implications of these insights are summarised below in relation to the learning environment (Section 6.3.1.1) and ICT use (Section 6.3.1.2).

6.3.1.1 Educational Implications of Actual and Preferred Differences in Students' Perceptions of their Learning Environments

Past research has indicated that students are likely to achieve better academically if their preferred environment is more closely matched to their actual environment (Fraser, 2012c). The results summarised in Section 6.2.2.1 (and reported in Section 5.2.1 of Chapter 5) of this thesis indicate that there were statistically significant differences between students' actual and preferred perceptions for all nine of the learning environment scales. As such, teachers would do well to examine the corresponding differences among their own students' perceptions in a bid to improve learning environments at the primary school level. In the present study, the three CCQ-P scales for which there was the greatest actual–preferred disparity were Personal Relevance, Involvement, and Equity. Therefore, the educational implications of the findings for these three scales are outlined below.

The actual–preferred gap found in the present study for the Personal Relevance scale suggests that students would prefer to participate in learning that is more relevant and meaningful to their daily lives than they currently experience. The actual–preferred gap for this scale is important in terms of Expectancy–Value Theory (Atkinson, 1966), which suggests that the outcome of a task must be seen to be valuable to learners in order for those learners to be willing to expend personal effort on the task. Students are unlikely to find a learning task valuable and authentic—and, consequently, to put effort into achieving a positive outcome—if they do not perceive the activity to be relevant to their daily lives. Pearson, Raphael, Benson, and Madda (2007, p. 36) state that:

The argument underlying the promotion of authenticity is that too many school tasks are unauthentic, unrealistic, and, by implication, not useful for engaging in real-world activities; that is, instead of teaching kids how to “do school,” we should be teaching them how to “do life.”

To improve personal relevance, teachers could endeavour to create learning opportunities for students that are applicable to the students' lives outside of school. Authentic tasks emulate real-life problems (Park, 2017) and therefore allow learners to contextualize learning, which promotes motivation (Parsons & Ward, 2011). According to Herrington and Oliver (2000), authentic tasks provide opportunities for exploration, involve authentic contexts that reflect how the knowledge will be used in real-life, and allow peer collaboration and the co-construction of knowledge. Tasks can also be made more authentic through the use of technology (Ahuja, 2016; Park, 2017; Valtonen et al., 2015). It is recommended, therefore, that teachers design and implement authentic tasks to assist students to understand the relevance of their learning for the real world (*Recommendation 9*).

Teachers could also narrow the actual–preferred gap for personal relevance by explicitly articulating lesson relevance—that is, how the lesson relates to the students' lives outside of school (*Recommendation 10*). Hattie (2012), Hollingsworth and Ybarra (2009), and McDonald (2003) all suggest that stating the lesson importance as part of the lesson structure is important as this statement assists students to understand how and why they might apply the concept being taught in the world outside of school. Understanding the importance of the concepts or skills being learnt provides motivation for learning, increases student engagement, and assists the brain to make meaning from the new information, making the content more likely to be remembered (Csikszentmihalyi, 2014; Hattie, 2012; Hollingsworth & Ybarra, 2009; McDonald, 2013).

The difference in the actual–preferred scores for the Involvement scale suggests that students want to feel more involved in their learning than they actually perceive themselves to be. To enhance student involvement in learning, it is recommended that teachers provide opportunities for students to be active participants in the learning process—for example, through teacher questioning and frequent opportunities for students to discuss, share, and explain their ideas with their peers (*Recommendation 11*). Learning is primarily social in nature (Ahuja, 2016; Bruner, 1986; Vygotsky, 1972) and requires learners to be actively involved in the learning process in order for knowledge to be constructed, thinking to be extended, and learning to be enhanced (Ahuja, 2016; Hattie, 2012; McDonald, 2013; Wright, 2015). The notion of students

as active learners has been linked to student engagement (Wright, 2015), which in turn corresponds to higher levels of academic success (Klem & Connell, 2004). According to Wright (2015), active learning requires interaction, collaboration, and an egalitarian relationship between teacher and student. Active learning empowers students to make decisions about their learning, analyse information, generate their own knowledge and understandings and allows students to contextualise knowledge in relation to the real world.

It is important for teachers to be conscious of ensuring the provision of more equitable opportunities for all students to be involved in learning. The disparity between students' actual and preferred scores for the Equity scale suggests that they would prefer teachers to treat them more fairly than is currently the case. The importance of this finding in the present study is confirmed by several researchers who suggest that how students and teachers interact with each other is integral to the classroom climate (Aldridge et al., 2016; Dweck, 2013; McDonald, 2013). Given that the extent to which teachers respond to and interact with students impacts significantly on student learning (Aldridge et al., 2016; Marchand & Skinner, 2007; Rowe & Stewart, 2009), equitable student–teacher interactions are vital so as not to disadvantage students (Jones & Dindia, 2004; Milner, 2010; Sadker & Silber, 2012). To close the actual–preferred gap in students' perceptions of classroom equity, it is recommended that teachers ensure that students receive equal opportunities to ask questions and take part in discussions and that students experience equal amounts of encouragement (*Recommendation 12*).

6.3.1.2 Educational Implications of Actual–Preferred Differences for ICT Use

In the present study, statistically significant differences existed between students' actual and preferred responses for the ICT Usage scales of Investigating with ICT and Communicating with ICT (see Section 5.2.2 of Chapter 5 and Section 6.2.2.2). The educational implications of these actual–preferred differences and ways in which teachers might address these differences are outlined below for each scale in turn.

Given that statistically significant actual–preferred differences existed for the Investigating with ICT scale, it is recommended that teachers strive to achieve greater integration of ICT into the classroom in terms of ICT being used to search for and

evaluate information and to investigate questions or problems (*Recommendation 13*). This approach is supported by Mitev and Crowther (2008), who argue that the internet is a technology that can be utilised in learning for exploration, investigation, and analysis rather than simply for the transfer of knowledge. This utilisation of technology enables teachers to adopt a more learner-centred approach, allowing students to be more actively involved in their learning (Byrne & Brodie, 2012; Echazarra et al., 2016; Mitev & Crowther, 2008; Maharaj-Sharma et al., 2017; Pearson, 2006; Romeo, 2006; Wong et al., 2006) whilst also developing their twenty-first century technological skills (Fraillon et al., 2014; Kim et al., 2014).

Twenty-first century life requires effective communication and collaborative problem-solving skills (Ahuja, 2016; Binkley et al., 2012; Echazarra et al., 2016; Maharaj-Sharma et al., 2017), providing an imperative for teachers to ensure that students are equipped with adequate digital skills. The statistically significant actual–preferred differences observed for the Communicating with ICT scale suggest that teachers should endeavour to provide increased opportunities for students to communicate using ICT. It is recommended, therefore, that this provision involve opportunities to communicate with their teacher, their peers, and the wider community and to share ideas and information with others to collaboratively construct knowledge and solutions (*Recommendation 14*). This actual–preferred gap can be narrowed by students communicating their learning using a variety of multimedia, such as through students and teachers sharing files and documents via email or communicating and collaborating on tasks through online learning platforms, thereby using ICT to enhance learning and the inquiry process (Ahuja, 2016; Binkley et al., 2012).

This section (Section 6.3.1) has discussed the educational implications of the findings of the present study in relation to the actual–preferred differences in students’ perceptions of their learning environment and their use of ICT in the classroom. The following section (Section 6.3.2) discusses the educational implications of the findings of the present study in relation to learning environment–outcome associations.

6.3.2 Educational Implications of the Associations Between the Learning Environment and Student Affective Outcomes

The results of the present study, in terms of the relationships between students' learning environment perceptions and their affective outcomes (as summarised in Section 6.2.3), reveal several insights. These insights suggest ways in which teachers can structure learning environments to enhance students' feelings of self-efficacy, enjoyment of their class, and enjoyment of using ICT. The implications of these insights are summarised in this section under the following headings:

- Self-Efficacy (Section 6.3.2.1);
- Enjoyment of Class (Section 6.3.2.2); and
- Enjoyment of Using ICT (Section 6.3.2.3).

6.3.2.1 Self-Efficacy

For the CCQ-P, the three highest statistically significant and positive correlations with the outcome of student self-efficacy were the Task Clarity, Task Orientation, and Involvement scales (as summarised in Section 6.2.3.1 and Section 5.3.1 of Chapter 5). The statistically significant correlations between each of the Task Clarity, Task Orientation, and Involvement scales and students' self-efficacy suggest that these three scales are independent predictors of student self-efficacy. The educational implications of these associations and how teachers might use this information to enhance students' self-efficacy are outlined below.

In terms of task clarity, the statistically significant correlation between task clarity and self-efficacy suggests that when students have a clear understanding of the instructions of the task and clear knowledge of how to successfully complete the task they feel an increased sense of efficacy. This finding suggests that to enhance students' self-efficacy, educators need to ensure that they give students clear instructions and success criteria before the students commence a task (*Recommendation 15*). This strategy is supported by several researchers including Gagne (1985), Hattie (2012), Hollingsworth and Ybarra (2009), and McDonald (2013).

In terms of task orientation, the statistically significant correlation between task orientation and the outcome of self-efficacy suggests that students experience a greater sense of self-efficacy when they understand the goal of a task and the importance of completing the task. According to Hattie (2012), having students set personal goals in relation to the task can assist student achievement. Frequent feedback and encouragement can also help to ensure students have optimal time-on-task (Bell & Aldridge, 2014; Hattie, 2012). Therefore, to enhance student self-efficacy, teachers should ensure that students understand the goals of tasks and the importance of completing tasks, and teachers should employ strategies to assist students to optimise on-task behaviours (*Recommendation 16*).

In terms of involvement, the correlation between student involvement and self-efficacy suggests that students experience increased feelings of self-efficacy when they perceive that they have opportunities to actively participate in the learning process. Given the social nature of learning (Ahuja, 2016; Bruner, 1986; Vygotsky, 1972), teachers should actively involve students in learning by allowing them to work co-operatively with their peers (Ahuja, 2016; Bell & Aldridge, 2014; Hattie, 2012; McDonald, 2013; Vygotsky, 1972; Wright, 2015), discuss their learning and make choices and decisions about their learning (Ahuja, 2016; Hattie, 2012; McDonald, 2013; Wright, 2015). Therefore, to enhance student self-efficacy, teachers should provide opportunities for students to be active participants in their learning—for example, through participation in discussions with their class and peers (*Recommendation 17*).

This section (Section 6.3.2.1) discussed the educational implications of the results of the present study, in terms of the relationships between students' learning environment perceptions and self-efficacy. The following section (Section 6.3.2.2) discusses the educational implications of the results, in terms of the relationships between students' learning environment perceptions and their enjoyment of class.

6.3.2.2 *Enjoyment of Class*

The CCQ-P scales for which there were the three highest statistically significant and positive correlations with students' enjoyment of class were the Teacher Support,

Personal Relevance, and Collaboration scales (as discussed in Section 6.2.3.2; see also Section 5.3.2 of Chapter 5). The educational implications of these associations, and ways in which teachers might use this information to enhance the extent to which students enjoy their learning environment, are outlined below.

The results of the present study suggest that the extent to which students perceive themselves to be supported by their teacher impacts on their enjoyment of their class. Numerous researchers claim that teacher support and the relationships between teachers and their students are crucial to affective student outcomes such as enjoyment (Bell, 2013; Strati et al., 2017; Petegem et al., 2007; Wolf & Fraser, 2008). As such, students' perceptions of the extent to which the teacher relates to and shows interest in them or assists students to learn may have an important impact on their enjoyment of class. The implications for teachers are that, in order to enhance student enjoyment of their class, teachers need to develop positive relationships with students, demonstrate that they care about the students' well-being, and actively provide instructional support for students (*Recommendation 18*). Teachers can make positive connections with students by taking an interest in them: for example, by getting to know the students' hobbies or favourite sporting team, their preferred learning style and learning interests, their family culture and background, or who their friends are. Teachers can demonstrate that they care for students by developing a sense of trust and showing empathy as well as through simple human interactions such as acknowledging individual students when they arrive at the classroom or when they are leaving for the day, smiling at students, acknowledging when a student returns to class after being absent, and thanking students. According to McDonald (2013), these strategies make students feel that they belong and are wanted in the classroom. Teachers can demonstrate instructional support by assisting students who require help with their academic tasks and building on students' strengths rather than focusing on their weaknesses (McDonald, 2013).

The results of the present study also suggest that, when students perceive that their learning is applicable and meaningful to their daily lives, they report greater enjoyment of class. Teaching relevant content allows teachers to establish meaningful contexts to build on prior knowledge and teach new concepts (Bell, 2013). The implication for teachers is that they should endeavour to provide learning opportunities for students

that have clear relevance and applicability to students' lives outside of school (*Recommendation 19*). Strategies for teachers to deliver lessons that are personally relevant have been discussed in Section 6.3.1.1.

Finally, the results of the present study suggest that students find their class more enjoyable when they have opportunities to collaborate with their peers. Therefore, to enhance students' enjoyment of class, teachers should provide increased opportunities for students to collaborate with each other to promote joint construction of knowledge (*Recommendation 20*). Laal (2013) lists the essential elements of collaborative learning as being positive interdependence, an obligation to rely on peers to achieve a common goal, student interactions that are intended to assist and encourage each other's learning, individual accountability, equitable workloads, social skills, and group self-evaluation. Teachers can encourage co-operation through allowing students to work together on tasks and to verbalise their learning in pairs or groups.

This section (Section 6.3.2.2) discussed the educational implications of the results of the present study, in terms of the relationships between students' learning environment perceptions and their enjoyment of class. The following section (Section 6.3.2.3) discusses the educational implications of the results, in terms of the relationships between students' learning environment perceptions and their enjoyment of using ICT in the classroom.

6.3.2.3 Enjoyment of Using ICT

The CCQ-P scales for which there were the three highest statistically significant and positive correlations with students' enjoyment of using ICT were task orientation, personal relevance, and collaboration (as discussed in Section 6.2.3.3; see also Section 5.3.3 of Chapter 5). The educational implications of these associations, are outlined below. Given that practical classroom strategies associated with these scales have been outlined in previous sections, links to these previously discussed strategies have been included below.

Given that task orientation was statistically significantly and positively related to students' enjoyment of ICT, when integrating ICT into the classroom to enhance the

degree to which students' experience enjoyment in the use of technology, teachers should ensure that students understand the goal of the assigned task and the importance of completing it (*Recommendation 21*). Given that personal relevance was also statistically significantly and positively related to students' enjoyment of ICT, teachers should seek to provide opportunities for students to use ICT in ways that are relevant to and meaningful for their daily lives (*Recommendation 22*). This notion is supported by Mitev and Crowther (2008), who suggest that ICT use in the classroom can provide a real-world context for learning which is relevant to students' lives outside of school and recommends using ICT to alter the transfer of knowledge from an abstract process to a more relevant contextual process. The correlation between collaboration and students' enjoyment of ICT in the results of the present study also suggests that to enhance students' enjoyment of using ICT, students should be allowed to collaborate with each other when using technology (*Recommendation 23*). Suggested strategies for teachers in relation to each of these recommendations can be found in the earlier sections related to Task Orientation (Section 6.3.2.1), Personal Relevance (Section 6.3.2.2), and Collaboration (Section 6.3.2.2).

This section (Section 6.3.2) has discussed the educational implications of the findings of the present study in relation to learning environment—outcome associations. The following section (Section 6.3.3) discusses educational implications in terms of the relationships that were found to exist between the use of ICT and affective student outcomes.

6.3.3 *Educational Implications of the Associations Between the Use of ICT and Student Affective Outcomes*

The results of the present study, in terms of the relationship between the perceptions of ICT use within the classroom and student outcomes (as summarised in Section 6.2.4 and reported in Section 5.4 of Chapter 5), reveal several insights that suggest how teachers can integrate ICT use into the learning environment in order to enhance students' feelings of self-efficacy, enjoyment of their class, and enjoyment of using ICT. The implications of these insights are summarised in this section.

The results summarised in Section 6.2.4.1 (and reported in Section 5.4 of Chapter 5) indicated that only the Changing Trends scale from the five ICT Usage Survey scales had a statistically significant impact on student self-efficacy. This suggests that the way in which ICT has enabled students to work differently may have made students feel more confident in their abilities to complete tasks successfully. This interpretation is supported by Aesaert and van Braak (2014) who argue that the way in which ICT has transformed the manner in which students learn in the classroom and students' perceptions of their ICT competencies impact on student efficacy. For teachers, this finding suggests that there is a need to recognise that the ways in which we complete tasks in our modern, technological world are changing. Our students have grown up in a world where the use of technology is commonplace. Therefore, based on the results of this study, it is recommended that teachers allow students to use new forms of ICT to complete tasks and demonstrate their learning in order to enhance students' self-efficacy (*Recommendation 24*). For example, teachers can allow students to use new forms of ICT (including programs, equipment, and applications) to assist with and demonstrate their learning rather than requiring students to continue to use older digital tools that the teacher may feel more familiar with.

It is also important to note that the results summarised in Section 6.2.3.1 indicated that positive and statistically significant relationships existed between five of the learning environment scales and self-efficacy, compared to a similarly positive and statistically significant relationship existing between only one of the ICT scales and self-efficacy. These results suggest that teachers wishing to enhance students' self-efficacy, would be better placed focusing on enhancing the learning environment rather than on greater integration of ICT (*Recommendation 25*). According to Mitev and Crowther (2008), given that the learning process involves interactions between students and teachers, technology is simply a tool to help educators in this process. As such, technology should be viewed as the next step in the development of teaching aids (for example, in the progression from whiteboards to overhead projectors to interactive whiteboards and digital projectors). Given that few studies exist in this area, it is recommended that future research is conducted to further investigate whether associations exist between the use of ICT in the classroom and either students' perceptions of their learning environment or affective student outcomes (*Recommendation 26*).

The results of the present study suggested that statistically significant and positive relationships existed between two of the five ICT Usage Survey scales and students' enjoyment of class: Investigating with ICT and Applying Social and Ethical Protocols and Practices. Given that the educational implications and practical classroom strategies associated with the Investigating with ICT scale and related student affective outcomes have been outlined in previous sections, a link to these previously discussed implications and strategies have been included below.

The results of the present study indicated that the extent to which students' perceived that they were encouraged to apply social and ethical protocols and practices when using ICT had a positive and statistically significant relationship to students' enjoyment of class (see Section 5.4.2 of Chapter 5 and Section 6.2.4). These results suggest that, in order to enhance the extent to which students experience enjoyment when using ICT in the classroom, educators need to ensure that students are taught social and ethically responsible practices. Various researchers have argued that when students are not taught social and ethical behaviours associated with ICT use, the negative effects of technology use have the potential to adversely affect their enjoyment of class (Leonard & Manly, 2011; OECD, 2015). Inappropriate uses of ICT which can result in negative effects include students providing personal information online (Ahuja, 2016; Leonard & Manly, 2011; OECD, 2015), engaging in inappropriate conversations (Leonard & Manly, 2011), ridiculing other students (Leonard & Manly, 2011), and cyber bullying (OECD, 2015). It would make sense, therefore, for the reverse to also be true, as the results of the present study suggest. That is, it is possible that when students are taught about social and ethical protocols and practices and their use of ICT is (as a result) free from these negative effects, they find the use of ICT more enjoyable. For example, students may report that they enjoy class more when they use ICT in ways that do not expose the students to cyber bullying or loss of personal security. The implication of this finding for teachers is that they should ensure that they teach students about social and ethically responsible practices for using ICT in order to ensure that students are able to safely and securely utilise ICT, including using correct social protocols for ICT and acknowledging digital intellectual property (*Recommendation 27*).

Given that the results of the present study revealed that statistically significant relationships existed between the Investigating with ICT scale and student enjoyment of class, it is recommended that teachers strive to achieve greater integration of ICT into the classroom in terms of ICT being used to search for and evaluate information and to investigate questions or problems (*Recommendation 13b*). Further information related the educational implications in relation to using ICT to investigate and suggested strategies for teachers can be found in Section 6.3.1.2.

The results summarised in Section 6.2.4 (and in Section 5.4.3 of Chapter 5) indicated that, of the five aspects of ICT use that were examined, Investigating with ICT (the extent to which the students had opportunities to search for and evaluate information with technology) was most strongly related to students' enjoyment of using ICT. Further, the results indicated that the way in which ICT has enabled students to work differently (Changing Trends scale) was also strongly related to students' enjoyment of using ICT. Given that practical classroom strategies associated with these two constructs and related student affective outcomes have been outlined in previous sections, a link to these previously discussed strategies have been included below.

In terms of the use of ICT to investigate, the implication for teachers is that, to enhance the degree to which students enjoy their use of ICT, teachers need to provide opportunities for students to use ICT to search for and evaluate information and to solve problems (*Recommendation 28*). Teachers also need to ensure that they provide opportunities for students to use evolving technologies to complete their work and demonstrate their learning (*Recommendation 29*). Suggested strategies for teachers in each of these respects can be found above for Changing Trends and in Section 6.3.1.2 for Investigating with ICT.

This section (Section 6.3.3) has discussed the educational implications of the findings of the present study in terms of the relationships that were found to exist between students' use of ICT and their affective outcomes of self-efficacy, enjoyment of class, and enjoyment of using ICT. The following section (Section 6.3.4) discusses implications in relation to the differences in the perceptions and affective outcomes of primary school students according to gender.

6.3.4 *Educational Implications of the Differences in Students' Perceptions and Outcomes According to Gender*

The results of the present study in terms of gender differences in students' perceptions and outcomes are summarised in Section 6.2.5 (and reported in Section 5.5 of Chapter 5). These findings offer some insights as to how teachers can structure the learning environment to enhance male and female students' perceptions and the key implications of these insights are summarised in this section. Given that no scales within the ICT Usage Survey or the SEEQ indicated practically significant differences according to gender, the educational implications of these two surveys according to gender are not discussed.

The results of this study suggested that the perceptions of males and females in relation to their learning environments were similar; however, generally, female students perceived the learning environment to be slightly better than male students did. The only scale for which males reported higher scores than females was Personal Relevance. This result suggests that male students perceived their learning to be more meaningful and relevant to their lives outside of school than female students did. Further information and strategies to support teachers' efforts to enhance personal relevance have been provided in Section 6.3.1.2.

Given that the results of the present study indicated that female students generally perceived their environment more positively than male students did, it is possible that learning environments may be more suited to female students than male students. According to Saidin and Brahim (2012) and Jørgensen (2015), male students generally underachieve compared to female students. Stahl (2012) suggests that positive teacher relationships are important to male students' engagement in the learning environment, and Jørgensen (2015) suggests that male students tend to have an anti-school culture and prefer having opportunities to master practical skills rather than concentrating on learning academic content. In comparison to female students, male students have different learning styles (Gurian, 2011; Saidin & Brahim, 2012); work differently (Saidin & Brahim, 2012); become bored and off-task more easily (Saidin & Brahim, 2012, Stahl, 2012); exhibit more behavioural issues (Jørgensen, 2015; Keddie & Mills, 2011; Saidin & Brahim, 2012); and demand greater amounts of teacher attention

(Saidin & Brahim, 2012; Sax, 2006). Some past research also suggests that male students are reluctant to expend effort in the learning environment because the manner in which effort, persistence, and compliance are rewarded in schools is aligned to a feminine code, meaning that to work hard challenges male students' masculinity (Connell 2000; Jørgensen, 2015; Keddie & Mills, 2011). Keddie and Mills (2011) argue that ensuring that the learning environment caters to the needs of boys enhances equity in the classroom. As such, classroom environments need to be altered to suit the needs of both genders (Keddie & Mills, 2011) because both genders can be disadvantaged if teachers don't understand and cater for gender differences (Sax, 2006). It is recommended, therefore, that teachers examine the gender differences in their own students' perceptions of the learning environment (in terms of the constructs measured by the nine CCQ-P scales) to determine how they might improve the perceptions of male students in relation to their classroom environment (*Recommendation 30*).

This section (Section 6.3.4) has discussed the educational implications of the key findings of the present study in terms of gender differences in students' perceptions of their learning environment. The following section (Section 6.3.5) discusses the educational implications of the differences in perceptions and affective outcomes that were observed in the present study for at-risk and not-at-risk students.

6.3.5 Educational Implications of the Differences in the Perceptions and Outcomes According to Risk Status

Section 6.2.6 (and Section 5.6 of Chapter 5) summarises the results of the present study in terms of the differences that were observed when the perceptions and outcomes of academically at-risk students were compared to the perceptions of those who are not considered to be at risk. These findings offer insights as to how teachers can structure the learning environment and use of ICT in order to enhance the perceptions of at-risk students and their associated outcomes of self-efficacy, enjoyment of class, and enjoyment of ICT use. The implications of these insights are discussed below in terms of differences in students' learning environment perceptions (Section 6.3.5.1); ICT usage (Section 6.3.5.2); and student affective outcomes (Section 6.3.5.3).

6.3.5.1 Risk Status Differences in Learning Environment Perceptions

The results summarised in Section 6.2.6.1 (and Section 5.6.1 in Chapter 5) indicated that statistically significant differences existed between the perceptions of academically at-risk students and those who were not at risk for the Equity, Task Clarity, Task Orientation, and Responsibility for Learning scales of the CCQ-P. At-risk students perceived the constructs described by these scales to be present in the learning environment to a lesser extent than students who were not at risk. This section (Section 6.3.5.1) discusses the educational implications of these results.

The results for the Equity scale suggest that at-risk students perceive there to be less equity (in terms of equal opportunities to be involved in the learning) than students who were not at risk did. This finding may suggest that at-risk students perceive that they are not being treated in a manner that is equal to their peers. As discussed in Section 6.2.6.1, it is possible that this perception could be a result of the pedagogical adjustments that teachers make to support the learning of at-risk students. Nevertheless, the results provide some insights for teachers when trying to best cater for at-risk students. Whilst teachers often treat at-risk students differently to their peers in an attempt to give them additional assistance, these findings suggest that they should be cognisant of doing so in a manner that does not make these students feel that they are not equal to their peers. Teachers need to be aware of ensuring that they give at-risk students equitable opportunities to be involved in their learning—for example, to participate in class discussions, share their ideas, and answer questions (*Recommendation 31*).

The statistically significant differences between the perceptions of at-risk students and those who were not at-risk for the Task Clarity scale suggest that students who are academically at-risk are less clear about the learning intentions and what is expected in order to complete the task successfully than not-at-risk students. The implication of this for educators is that teachers need to examine how they explain tasks to at-risk student to ensure that these students are not disadvantaged. According to Westwood (2004), at-risk students require explicit teaching methods to be able to successfully complete tasks. As such, to support the learning of at-risk students, it is recommended that teachers provide clear learning intentions, instructions, practice examples, and

success criteria in order to enhance task clarity (Gagne, 1985; Hattie, 2012; Hollingsworth & Ybarra, 2009; McDonald, 2013; Westwood, 2004; *Recommendation 32*)

The statistically significant differences observed for the Responsibility for Learning scale suggest that, in comparison to their peers, at-risk students perceive that they are given less frequent opportunities to work independently and take responsibility for their learning than students who are not at-risk. According to Westwood (2004), at-risk students require opportunities to set their own goals, make choices, and have some control over what they do in the classroom and the manner in which they do it. Although it is often necessary for at-risk students to be offered additional time and support by the teacher, the results of this study suggest that teachers should endeavour to provide opportunities for at-risk students to work independently and feel responsible for their own learning (*Recommendation 33*).

The statistically significant differences for the Task Orientation scale suggest that, in comparison to their peers, at-risk students perceive that they have less understanding of the work they are doing and are less focused on completing the assigned task. According to Westwood (2004), the tendencies of at-risk students to focus on irrelevant details and to become easily distracted from a task have the potential to be detrimental to learning. As such, it is recommended that at-risk students be supported through close supervision (Westwood, 2004), regular attentional cues (Snell & Brown, 2000), training in self-regulation strategies (Westwood, 2004), explicit links to prior knowledge (Westwood, 2004), and strategies intended to grab and maintain these students' attention (Hunt & Marshall, 2002; *Recommendation 34*).

6.3.5.2 Risk Status Differences in ICT Usage Perceptions

In the present study, the average item mean for the Applying Social and Ethical Protocols and Practices scale was higher for students who were above the minimum standard than for at-risk students (see Section 5.6.2 and Section 6.2.6.2). This result indicated that not-at-risk students perceived that they had been reminded to use ICT ethically and in a socially appropriate manner more often than those who were at-risk

perceived this. Several items within this scale relate to digital and online safety such as:

- *In this class, I am reminded never to share my password(s);*
- *In this class, I am reminded to never share my private information online;*
and
- *In this class, I am reminded of the need to be careful when sharing information in online communities.*

Therefore, the results of this study indicate a need for teachers to ensure that at-risk students, in particular, are aware of cyber safety when communicating with others online, as according to Westwood (2014), the potential exists for at-risk students to be more vulnerable in this area (*Recommendation 35*).

6.3.5.3 Risk Status Differences in Affective Outcomes

The results of the SEEQ, summarised in Section 6.2.6.3 (and in Section 5.6.3 of Chapter 5), indicate that academically at-risk students experienced less favourable attitudes in relation to self-efficacy than students who are not at-risk. This difference was statistically significant for both self-efficacy and enjoyment of class.

To enhance students' self-belief in their ability, Klassen (2010), suggests that students who are academically at risk require additional instruction, guidance, repetition, and practice to foster their confidence in their own learning. Hollingsworth and Ybarra (2009) and Westwood (2004) also purport that repetition and practice are essential for moving knowledge from the short-term to the long-term memory and that these opportunities are particularly important for at-risk students.

Suggested strategies for teachers can also be found in Bandura's (1977) work in the area of self-efficacy. First, Bandura (1977), highlights that academically at-risk students require mastery experiences to build their self-belief; that is, these students need frequent experiences of success and fewer experiences of failure (which undermine self-efficacy). Second, Bandura (1977) suggests that at-risk students benefit from observing others who are successful. That is, these students need frequent

opportunities to observe others, such as teachers and peers, successfully completing tasks or demonstrating skills. This strategy is supported by Klassen (2010), who claims that Observing the attainment of others can provide valuable feedback about one's own relative competencies (Klassen, 2010). Third, Bandura (1977) suggests that social persuasion such as encouragement and support from teachers and peers can enhance a person's belief in their own abilities. In summary, therefore, it is recommended that, to enhance the self-efficacy of at-risk students, teachers employ strategies including additional instruction, practice and repetition; mastery experiences; opportunities to observe successful others; and social persuasion (*Recommendation 36*).

The results of the present study also indicate that academically at-risk students experience less favourable attitudes in terms of enjoyment of class than students who are not considered to be at risk. Milsom and Glanville (2010) and Westwood (2004) found that correlations exist between learning difficulties and poor social skills, placing students who exhibit learning difficulties at greater risk of experiencing bullying or lacking friendships at school. As such, Milsom and Glanville (2010) and Westwood (2004) suggest that, in addition to academic interventions, teachers should focus on helping at-risk students to develop effective social skills to enable these students to form effective relationships, particularly with their peers, which, in turn, is likely to enhance their enjoyment of the learning environment. It is, therefore, recommended that to enhance at-risk students' enjoyment of class, teachers foster positive relationships with these students and focus on enhancing these students' social skills (*Recommendation 37*).

6.4 Limitations of the Study

As with all research, this study is not free of limitations or biases, particularly given that the research subjects were children of a young age. Therefore, generalisations from the results of this study should be made with caution. Three key limitations of the present study are outlined below.

The schools within the sample of the present study were drawn only from the Catholic Education sector within Western Australia; as a result, the sample did not accurately

represent either the general population or the various contexts of particular Australian states. To further examine the applicability and reliability of each of the newly developed instruments developed for this study (the CCQ-P, the ICT Usage Survey, and the SEEQ), it is recommended that future research use larger samples that provide more complete representation of the general Australian student population, including sampling students from state and independent schools across the nation (as noted earlier; see *Recommendation 1*).

The exploratory nature of the present study lent itself to a quantitative approach; however, as a result, causal explanations of the results were not able to be determined. According to Tran (2016), the inclusion of qualitative data can allow triangulation (thus enhancing validity) and provide richer data in relation to suggested explanations for relationships, allowing causal effects to be explored. Therefore, it is recommended that future research involve a mixed-method approach to allow deeper insights and explanations associated with the relationships between the constructs investigated in the present study (*Recommendation 38*).

The present study was undertaken to examine students' perceptions of their learning environment and use of ICT as well as the impact of these perceptions on key affective outcomes. A limitation of this research was that only the outcomes of self-efficacy and enjoyment (of class and ICT) were examined. It is recommended, therefore, that further research is conducted to examine the impact of students' perceptions of their learning environment and use of ICT on other student outcomes such as student engagement, motivation, and achievement (*Recommendation 39*).

This section (Section 6.4) has discussed the limitations of the research described in this thesis. The following section (Section 6.5) lists the recommendations that have been made throughout this chapter.

6.5 Summary of Recommendations

Recommendation 1: To further examine the applicability and reliability of the instruments developed for this study, it is recommended that future research examine the validity

and reliability of each instrument across more diverse student samples (for example, across different educational sectors and geographical contexts). This recommendation relates to the CCQ-P (Recommendation 1a), the ICT Usage Survey (Recommendation 1b), and the SEEQ (Recommendation 1c).

Recommendation 2: Given that the students in the present study reported lower preferred scores than actual scores for the Task Orientation scale (contradicting results seen in other learning environments research), it is recommended that future research be conducted involving mixed-method approaches to afford deeper insights into the relationships between the constructs investigated in the present study and to provide causal explanations for this irregular result.

Recommendation 3: Given the lack of research into gender perception differences in relation to the primary school learning environment, it is recommended that future research further examine the differences in the perceptions of male and female primary school students. This future research should include qualitative studies to examine whether the more positive perceptions of female students reflected consistently across many studies (that is, that females are generally more positive) or whether learning environments are, in fact, more suited to female students.

Recommendation 4: Given the mixed results in previous research related to gender perception differences of ICT use in the classroom, it is recommended that further research is conducted into the preferences of male and female

students in relation to ICT use in the classroom and into how teachers can integrate the use of technology to cater for differing learning preferences according to gender.

Recommendation 5: Given that no past studies could be found that examined self-efficacy according to gender at a primary school level, it is recommended that further research is conducted into gender differences primary school students' self-efficacy beliefs.

Recommendation 6: Given the lack of existing studies into gender differences in student enjoyment, it is recommended that further research be conducted to determine whether the lack of gender difference (reported in this study) is typical at the primary school level and whether enjoyment levels alter in gender-related ways as students move to secondary school.

Recommendation 7: Given that the present study identified differences between the perceptions of at-risk and not-at-risk students in relation to classroom equity, it is recommended that further research examines whether teachers' attempts to support the learning of academically at-risk students (thereby treating at-risk students differently to their classmates) result in at-risk students perceiving the learning environment to be inequitable.

Recommendation 8: Given that computer-aided instruction is known to assist the learning of at-risk students but given that the results of the present study suggested that at-risk students reported less ICT usage than their not-at-risk classmates, it is recommended that teachers pay

attention to this difference and provide more ICT to at-risk students.

- Recommendation 9: Given the positive and statistically significant differences in students' actual–preferred responses for the Personal Relevance scale of the CCQ-P, it is recommended that teachers design and implement authentic tasks to assist students to understand the relevance of their learning for the real world.
- Recommendation 10: Given the positive and statistically significant differences in students' actual–preferred responses for the Personal Relevance scale of the CCQ-P, it is recommended that teachers explicitly articulate lesson relevance (that is, how the lesson relates to the students' lives outside of school).
- Recommendation 11: Given the positive and statistically significant differences in students' actual–preferred responses for the Involvement scale of the CCQ-P, it is recommended that teachers provide opportunities for students to be active participants in the learning process (for example, through teacher questioning and frequent opportunities to discuss, share, and explain their ideas with their peers).
- Recommendation 12: Given the positive and statistically significant differences in students' actual–preferred responses for the Equity scale of the CCQ-P, it is recommended that teachers ensure that students receive equal opportunities to ask questions and take part in discussions and that students experience equal amounts of encouragement.

Recommendation 13: Given that positive and statistically significant actual–preferred differences were identified for the Investigating with ICT scale as well as a positive and statistically significant relationship between this scale and students’ enjoyment of class, it is recommended that teachers strive to achieve greater integration of ICT into the classroom in terms of ICT being used to search for and evaluate information and to investigate questions or problems. This recommendation relates to the ICT Usage Survey (Recommendation 13a), and the SEEQ (Recommendation 13b).

Recommendation 14: Given that positive and statistically significant actual–preferred differences were identified for the Communicating with ICT scale, it is recommended that teachers provide opportunities for students to communicate using ICT, including opportunities to communicate with their teacher, their peers, and the wider community as well as opportunities to share ideas and information with others to collaboratively construct knowledge and solutions.

Recommendation 15: Given that positive associations existed between task clarity and self-efficacy in the present study, it is recommended that teachers give students clear instructions and explicit success criteria before the students commence a task.

Recommendation 16: Given that positive associations existed between task orientation and self-efficacy in the present study, it is recommended that teachers ensure that students understand the goals of tasks and the importance of completing tasks and that teachers employ strategies to assist students to optimise on-task behaviours.

- Recommendation 17: Given that positive associations existed in the present study between the Involvement scale of the CCQ-P and self-efficacy, it is recommended that teachers provide opportunities for students to be active participants in their learning (for example, through participation in discussions with their class and peers).
- Recommendation 18: Given that the Teacher Support scale in the CCQ-P was statistically significantly and positively related to students' enjoyment of class, it is recommended that teachers develop positive and supportive relationships with their students, demonstrate that they care about the students' well-being, and actively provide instructional support for students.
- Recommendation 19: Given that the Personal Relevance scale in the CCQ-P was statistically significantly and positively related to students' enjoyment of class, it is recommended that teachers provide learning opportunities for students that have clear relevance and applicability to students' lives outside of school.
- Recommendation 20: Given that the Collaboration scale of the CCQ-P was statistically significantly and positively related to students' enjoyment of class, it is recommended that teachers provide increased opportunities for students to collaborate with each other to promote joint construction of knowledge.
- Recommendation 21: Given that statistically significant and positive relationships existed between task orientation and students' enjoyment of ICT, it is recommended that when using ICT in the classroom, teachers ensure that

students understand the goal of the assigned task and the importance of completing it.

Recommendation 22: Given that personal relevance was statistically significantly and positively related to enjoyment of ICT in the present study, it is recommended that teachers provide opportunities for students to use ICT in ways that are relevant to and meaningful for to their daily lives.

Recommendation 23: Given that collaboration was statistically significantly and positively related to students' enjoyment of ICT in the present study, it is recommended that students be allowed to collaborate with each other when using technology.

Recommendation 24: Given that statistically significant and positive relationships existed between the Changing Trends ICT scale and students' self-efficacy, it is recommended that students be allowed to use new forms of ICT to complete tasks and demonstrate their learning.

Recommendation 25: Given that, overall, students' self-efficacy appeared to be more strongly influenced by aspects of the learning environment than by ICT use, it is recommended that to enhance student self-efficacy, teachers focus more on enhancing the learning environment than on the integration of ICT.

Recommendation 26: Given that, overall, students' self-efficacy appeared to be more strongly influenced by aspects of the learning environment than by ICT use, it is recommended that future research examine whether associations exist between the use of ICT in the classroom and either

students' perceptions of their environment or affective student outcomes.

Recommendation 27: Given that the Applying Social and Ethical Protocols and Practices ICT scale was statistically significantly and positively related to students' enjoyment of class, it is recommended that educators teach social and ethically responsible practices when using ICT to ensure that students are able to use ICT safely, securely, and ethically.

Recommendation 28: Given that the Investigating with ICT scale was statistically significantly and positively related to students' enjoyment of using ICT, it is recommended that teachers provide opportunities for students to use ICT to search for and evaluate information and to solve problems.

Recommendation 29: Given that the Changing Trends scale was statistically significantly and positively related to students' enjoyment of ICT, it is recommended that teachers provide opportunities for students to use evolving technologies to complete their work and demonstrate their learning.

Recommendation 30: Given that the female students in the present study generally perceived their learning environment more positively than male students did, it is recommended that teachers examine the gender differences in their own students' perceptions of the learning environment (in terms of the constructs measured by the nine CCQ-P scales) to determine how they might improve the perceptions of male students in relation to their classroom environment.

- Recommendation 31: Given that the results of the present study indicated that academically at-risk students perceived there to be less equity than students who were not considered to be at-risk, it is recommended that teachers provide equitable opportunities for at-risk students to be involved in their learning, for example, to participate in class discussions, share their ideas and answer questions.
- Recommendation 32: Given that the results of the present study indicated that at-risk students reported less task clarity than not-at-risk students did, it is recommended that teachers provide clear learning intentions, instructions, practice examples, and success criteria in order to enhance task clarity.
- Recommendation 33: Given that the results of the present study indicated that, compared to their peers, at-risk students perceived that they had fewer opportunities to take responsibility for their learning, it is recommended that teachers provide opportunities for at-risk students to work independently and feel responsible for their own learning.
- Recommendation 34: Given that the results of the present study indicated that, compared to their peers, at-risk students reported lower levels of task orientation, it is recommended that teachers support at-risk students through close supervision, regular attentional cues, training in self-regulation strategies, explicit links to prior knowledge, and strategies intended to grab and maintain these students' attention.
- Recommendation 35: Given that at-risk students reported lower scores on the Applying Social and Ethical Protocols and Practices ICT scale than not-at-risk students, it is recommended

that teachers ensure that at-risk students, in particular, are aware of cyber safety when communicating with others online.

Recommendation 36: Given that the results of the present study suggested that at-risk students experienced lower of self-efficacy than students who were not at risk, it is recommended that teachers employ strategies to cater for at-risk students including additional instruction, practice and repetition; mastery experiences; opportunities to observe successful others; and social persuasion.

Recommendation 37: Given that the results of the present study indicated that at-risk students experienced lower levels of enjoyment of class than students who were not at-risk, it is recommended that teachers foster positive relationships with at-risk students and focus on enhancing these students' social skills.

Recommendation 38: To provide deeper insights and explanations into the relationships between the constructs investigated in the present study, it is recommended that future research involve mixed-method approaches.

Recommendation 39: Given that the only outcomes included in this study were students' self-efficacy and enjoyment (of class and of ICT), it is recommended that further research be conducted to examine the impact of students' perceptions of their learning environment and use of ICT on other student outcomes such as student engagement, motivation, and achievement.

This section (Section 6.5) has provided a summary of the recommendations that have been provided through this chapter. The following section (Section 6.6) outlines the significance of the present study.

6.6 Significance of the Study

Despite the limitations outlined in Section 6.4, the results of the present study are significant and contribute to the wider field of learning environments research in a number of ways. The present research is of methodological, theoretical, and practical significance to the field of learning environments research. This study makes available three new learning environment surveys (methodological significance), extends the current findings in the field of learning environments research (theoretical significance), and provides practical insights for educators to enhance the learning environment (practical significance). The significance of the findings of the present study are further outlined below in relation to each of these three categories.

The present study is of methodological significance as it provides researchers and teachers with three new learning environment surveys. First, the present study makes available a valid and reliable tool for assessing primary school-aged students' perceptions of their learning environment (the CCQ-P). The development of this survey drew on seven established scales from the COLES (Aldridge, Fraser, et al., 2012) and the survey has been validated using Trochim and Donnelly's (2008) construct validity framework (See Section 3.6.1.1 of Chapter 3 and Section 4.2 of Chapter 4). This methodological contribution is significant given that few learning environment questionnaires have previously been available that are suitable for use at the primary school level and for the Australian context.

Second, the present study provides researchers and teachers a newly developed instrument to assess student perceptions of ICT usage in the primary school classroom (the ICT Usage Survey). To the best of the researcher's knowledge, no other research tool exists that allows teachers to gather information about the perceptions of students in relation to the use of integration in the classroom. This instrument was validated using Trochim and Donnelly's (2008) construct validity framework and is a valid and reliable tool that can be used by researchers and teachers.

Third, the present study has also made available a valid and reliable tool to assess the student outcomes of self-efficacy, enjoyment of class, and enjoyment of ICT at a primary school level. The SEEQ was developed based on scales from the ASBS (Bell & Aldridge, 2014) and validated using Trochim and Donnelly's (2008) construct validity framework. Few instruments exist to assess student self-reports of affective outcomes at a primary school level, and to the best of the researcher's knowledge, no other instrument exists to measure students' use of and enjoyment of ICT in the primary school classroom.

The comprehensive validation of these three new surveys (related to research objective 1) provides strong support for their validity and reliability, meaning that this study has provided three psychometrically sound instruments that can be drawn upon by researchers in future studies.

The results of the present study (related to research objectives 2 to 6) are of theoretical significance as they extend the current findings in the field of learning environments research. Given that relatively few studies in the field of learning environments have been conducted at the primary school level, particularly within Australia, the findings of the present study contribute to insights in this field in relation to the perceptions of primary school aged students about their learning environment. Similarly, given that few instruments exist to assess primary school students' perceptions of ICT use within the classroom and their self-reports of affective outcomes related to their learning environment and use of ICT, the findings of the present study offer important theoretical insights into the perceptions of primary school aged students. Few studies also exist at the primary school level into student gender perception differences and the differences in perception of academically at-risk and not-at-risk students. Thus, the insights provided by the results of the present study extend the field of learning environments research in relation to the perceptions of male and female students and at-risk and not-at-risk students at the primary school level.

The results related to research objectives 2 to 6 of this study are of practical significance as they provide practical insights for the CEWA system, school leaders and teachers to enhance the learning environment. The significance for each of these stakeholders is described below.

The results reported in this thesis provide practical insights for the CEWA system, given that the sample was drawn from the Catholic education sector alone. The present research provides valuable insights into the students' perceptions of classroom environments within Catholic primary schools in Western Australia as well as into the impact of the learning environment and the use of ICT on students' affective outcomes (self-efficacy, enjoyment of class, and enjoyment of using ICT).

The results of the present study provide practical insights for school leaders and teachers as some generalisations can be made from these results which can be utilised by primary school teachers (particularly those within the CEWA system) to enhance the classroom environment and the integration of ICT as well as to cater for the differing needs of male and female students and at-risk students. At school levels, training and support could be provided by educational leaders for teachers in these areas. The key generalisations from this study that can be utilised by teachers are summarised below.

In terms of the classroom environment, common themes that arose from the results of the present study related to the importance of teachers providing clear instructions, learning intentions, and success criteria, as well as clarifying the purposes of authentic and meaningful tasks. The results of this research also suggested that learning environments can be enhanced through teachers involving students in active learning and taking steps to enhance equity in the classroom.

In terms of using ICT, these results indicated that students would prefer greater opportunities to use ICT to investigate and communicate than they currently experience. In terms of enhancing the learning environment for at-risk students, implementing strategies designed to enhance the levels of teacher support, equity, task clarity, and task orientation would be beneficial along with ensuring that at-risk students are protected when using ICT through the explicit teaching of social and ethical protocols and practices for digital technologies.

In summary, results of the present study are significant in three ways. First, the present study provides researchers and educators with three new instruments to gather student perception data about the learning environment, use of ICT in the classroom and assess

the related student affective outcomes (self-efficacy, enjoyment of class, and enjoyment of using ICT) which is of methodological significance. Second, the results of the present study are of theoretical significance as they extend the current field of learning environments research by providing insights (which, to date, have been lacking) into the perceptions of primary school aged students. Third, the findings of this study also offer significant practical insights to the CEWA system, school leaders and teachers. For example, the results and recommendations of this study have the potential to inform and guide school leaders and teachers in their efforts to create positive learning environments and to enhance the use ICT in the classroom. The study also offers practical information about specific dimensions of the primary school-level classroom climate that can be modified to enhance student affective outcomes.

This section (Section 6.6) has provided a summary of the significance of the present study. The following section (Section 6.7) ends this thesis, providing concluding remarks from the researcher.

6.7 Concluding Remarks

The present research is of methodological, theoretical, and practical significance to the field of learning environments research. This study makes available three new surveys, extends the current findings in the field of learning environments research, and provides practical insights for educators to enhance the learning environment.

This study contributes to the wider field by making available, to both teachers and researchers, three new instruments that are suitable for use at the primary school level to assess students': perceptions of the learning environment; use of ICT in the classroom; and self-reports of self-efficacy, enjoyment of class, and enjoyment of using ICT. These surveys were shown to be psychometrically sound and economical for use, making them useful tools of types that, hitherto, have not been available for use with students of primary school age. The new instruments may be useful to teachers and school leaders, as the instruments enable student feedback to be gathered that can inform classroom and school improvement in a way that has been successful at the secondary level but has previously been unavailable to primary school educators.

The results of the present study provide information that teachers can use to improve learning environments in ways that may benefit students. The results documented in the present study provide important insights for teachers in terms of tailoring learning environments to suit students' preferences, to cater for students' differing needs according to gender, and to support at-risk students. The results, in terms of elements of the learning environment that are related to student affective outcomes, provides information that could guide teachers regarding where they might focus their energy in order to improve of the learning environment to enhance students' outcomes.

One of the most important findings of the present study—and one which is of practical significance to teachers—is that aspects of the learning environment were found to more strongly influence student self-efficacy than ICT use did. These findings may suggest that the teaching pedagogy and the relationships in the classroom may impact students' affective outcomes more than the use of ICT does. Although the results of the present study suggest that ICT is a tool that can be used by teachers to create a more favourable learning environment, overall, the results suggested that the use of ICT, without consideration of the learning context, may not have a high impact on student outcomes.

Overall, the findings of the present study provide insights for primary school educators in terms of how they can foster effective classroom environments that positively impact students' outcomes. It is hoped that the use of the three newly developed instruments and the information gathered in the results of the present study will help teachers to create optimal learning environments that significantly enhance students' affective outcomes and, ultimately, student achievement.

REFERENCES

- ACARA (Australian Curriculum, Assessment and Reporting Authority). (n.d.). *Information and communication technology (ICT) capability*. Retrieved from <https://www.australiancurriculum.edu.au/f-10-curriculum/general-capabilities/information-and-communication-technology-ict-capability/>
- Aesaert, K., & van Braak, J. (2014). Exploring factors related to primary school pupils' ICT self-efficacy: A multilevel approach. *Computers in Human Behavior, 41*, 327–341.
- Aesaert, K., Van Nijlen, D., Vanderlinde, R., Tondeur, J., Devlieger, I., & van Braak, J. (2015). The contribution of pupil, classroom and school level characteristics to primary school pupils' ICT competences: A performance-based approach. *Computers & Education, 87*, 55–69.
- Agarwal, R., & Karahanna, E. (2000). Time flies when you're having fun: Cognitive absorption and beliefs about information technology usage. *Management Information Systems Quarterly, 24*(4), 665–694.
- Ahuja, A. (2016). Integration of information and communication technology in school curriculum. *Learning Community, 7*(1), 1–8.
- Ainley, M., & Ainley, J. (2011). Student engagement with science in early adolescence: The contribution of enjoyment to students' continuing interest in learning about science. *Contemporary Educational Psychology, 36*(1), 4–12.
- Aldridge, J. M., Afari, E., & Fraser, B. J. (2012). Influence of teacher support and personal relevance on academic self-efficacy and enjoyment of mathematics lessons: A structural equation modeling approach. *Alberta Journal of Educational Research, 58*(4), 614–633.
- Aldridge, J. M., Dorman, J. P., & Fraser, B. J. (2004). Use of multitrait–multimethod modelling to validate actual and preferred form of the Technology-Rich

Outcomes-Focussed Learning Environment Inventory (TROFLEI). *Australian Journal of Educational and Developmental Psychology*, 4, 110–125.

Aldridge, J. M., & Fraser, B. J. (2000). A cross-cultural study of classroom learning environments in Australia and Taiwan. *Learning Environments Research*, 3(2), 101–134.

Aldridge, J. M., & Fraser, B. J. (2008). *Outcomes-focused learning environments: Determinants and effects*. Rotterdam, The Netherlands: Sense.

Aldridge, J. M., & Fraser, B. J. (2011). Monitoring an outcomes-focused learning environment: A case study. *Curriculum Perspectives*, 31(1), 25–41.

Aldridge, J. M., Fraser, B. J., Bell, L. M., & Dorman, J. (2012). Using a new learning environment questionnaire for reflection in teacher action research. *Journal of Science Teacher Education*, 23(3), 259–290.

Aldridge, J. M., Fraser, B. J., Fozdar, F., Ala'i, K., Earnest, J., & Afari, E. (2016). Students' perceptions of school climate as determinants of wellbeing, resilience and identity. *Improving Schools*, 19(1), 5–26.

Aldridge, J. M., Fraser, B. J., & Huang, I. T. (1999). Investigating classroom environments in Taiwan and Australia with multiple research methods. *Journal of Educational Research*, 93(1), 48–62.

Aldridge, J. M., Fraser, B. J., & Ntuli, S. (2009). Utilising learning environment assessments to improve teaching practices among in-service teachers undertaking a distance education programme. *South African Journal of Education*, 29(2), 147–170.

Aldridge, J. M., Fraser, B. J., & Sebela, M. P. (2004). Using teacher action research to promote constructivist learning environments in South Africa. *South African Journal of Education*, 24(4), 245–253.

- Aldridge, J. M., Fraser, B. J., Taylor, P. C., & Chen, C. C. (2000). Constructivist learning environments in a cross-national study in Taiwan and Australia. *International Journal of Science Education, 22*(1), 37–55.
- Aldridge, J. M., & Galos, S. (2017). Development and validation of an instrument to assess primary school students' perceptions of the learning environment. *Learning Environments Research, 20*(1), 1–20.
- Aldridge, J., McChesney, K., & Afari, E. (in press). Relationships between school climate, bullying and delinquent behaviours. *Learning Environments Research*. <https://doi.org/10.1007/s10984-017-9249-6>.
- Aleamoni, L. M. (1999). Student rating myths versus research facts. *Journal of Personnel Evaluation in Education, 13*(2), 153–166.
- Alessi, S. M., & Trollip, S. R. (2001). *Multimedia for learning: Methods and development*. Boston, MA: Allyn & Bacon.
- Alexakos, K., & Antoine, W. (2003). The gender gap in science education. *Science Teacher, 70*(3), 30–33.
- Alkharusi, H., Aldhafri, S., Alnabhani, H., & Alkalbani, M. (2014). Modeling the relationship between perceptions of assessment tasks and classroom assessment environment as a function of gender. *Asia-Pacific Education Researcher, 23*(1), 93–104.
- Allen, D., & Fraser, B. (2007). Parent and student perceptions of classroom learning environment and its association with learning outcomes. *Learning Environments Research, 10*(1), 67–82.
- Al Zubaidi, E., Aldridge, J. M., & Khine, M. S. (2016). Learning English as a second language at the university level in Jordan: Motivation, self-regulation and learning environment perceptions. *Learning Environments Research, 19*(1), 133–152.

- An, H., Alon, S., & Fuentes, D. (2015). iPad implementation approaches in K–12 school environments. In H. An, S. Alon, & D. Fuentes (Eds.), *Tablets in K-12 education: Integrated experiences and implications* (pp. 22–33). Hershey, PA: IGI Global.
- Anderson, G. J., & Walberg, H. J. (1968). Classroom climate and group learning. *International Journal of Educational Sciences*, 2, 175–180.
- Angrist, J., & Lavy, V. (2002). New evidence on classroom computers and pupil learning. *The Economic Journal*, 112(482), 735–765.
- Appel, M. (2012). Are heavy users of computer games and social media more computer literate? *Computers & Education*, 59(4), 1339–1349.
- Ashby, F. G., Isen, A. M., & Turken, A. U. (1999). A neuropsychological theory of positive affect and its influence on cognition. *Psychological Review*, 106(3), 529–550.
- Ates, H. (2013). Information technology and the learning environment in primary schools. *Social and Behavioral Sciences*, 93(1), 695–698.
- Atkinson, J. W. (1966). Motivational determinants of risk taking behaviour. In J. W. Atkinson & N. T. Feather (Eds.), *A theory of achievement motivation* (pp. 11–31). New York, NY: Wiley.
- Australia Bureau of Statistics. (2017). *Australian Demographic Statistics*. Retrieved from <http://www.abs.gov.au/ausstats/abs@.nsf/0/D56C4A3E41586764CA2581A70015893E?Opendocument>
- Australian Institute for Teaching and School Leadership. (2014). *Australian professional standards for teachers*. Melbourne, Australia: Author.
- Ayers, H., & Grey, F. (2013). *An A to Z practical guide to learning difficulties*. Hoboken, NJ: Taylor & Francis.

- Bailey, R. (2009). Well-being, happiness and education. *British Journal of Sociology of Education, 30*(6), 795–802.
- Bain, C. D., & Rice, M. L. (2007). The influence of gender on attitudes, perceptions, and uses of technology. *Journal of Research on Technology in Education, 39*(2), 119–132.
- Baird, G. L., Scott, W. D., Dearing, E., & Hamill, S. K. (2009). Cognitive self-regulation in youth with and without learning disabilities: Academic self-efficacy, theories of intelligence, learning vs. performance goal preferences, and effort attributions. *Journal of Social and Clinical Psychology, 28*(7), 881–908.
- Baker, L., & Wigfield, A. (1999). Dimensions of children's motivation for reading and their relations to reading activity and reading achievement. *Reading Quarterly Research, 34*(4), 452–477.
- Balci, O. (2003). Verification, validation, and certification of modelling and simulation applications. In D. Ferrin, D. J. Morrice, P. J. Sanchez, & S. Chick (Eds.), *Proceedings of the 2003 Winter Simulation Conference*. New Orleans, LA: Institute of Electrical and Electronics Engineers.
- Bandura, A. (1977). Self-efficacy: Towards a unifying theory of behavioural change. *Psychological Review, 84*(2), 191–215.
- Bandura, A. (1978). The self system in reciprocal determinism. *American Psychologist, 33*(4), 344–358.
- Bandura, A. (1989). Human agency in social cognitive theory. *American Psychologist, 44*(9), 1175–1184.
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York, NY: Freeman.

- Bandura, A. (2006). Guide for creating self-efficacy scales. In F. Pajares & T. Urdan (Eds.), *Self-efficacy beliefs of adolescents* (pp. 307–339). Greenwich, CT: Information Age.
- Bandura, A., Barbaranelli, C., Caprara, G. V., & Pastorelli, C. (2001). Self-efficacy beliefs as shapers of children's aspirations and career trajectories. *Child Development, 72*(1), 187–206.
- Barlow, D. (1991). At-risk students. *The Education Digest, 56*(8), 16–19.
- Bassi, M., Steca, P., Fave, A. D., & Caprara, G. V. (2007). Academic self-efficacy beliefs and quality of experience in learning. *Journal of Youth and Adolescence, 36*(3), 301–312.
- Bell, L. M. (2013). *Investigating the use of teacher action research based on students' perceptions of the learning environment to improve secondary high school classrooms* (Doctoral thesis). Retrieved from <https://espace.curtin.edu.au/handle/20.500.11937/1160>
- Bell, L. M., & Aldridge, J. M. (2014). *Student voice, teacher action research and classroom improvement*. Rotterdam, The Netherlands: Sense.
- Bernard, J. (2012). *A place to learn: Lessons from research on learning environments*. Montreal, Canada: UNESCO Institute for Statistics.
- Binkley, M., Erstad, O., Herman, J., Raizen, S., Ripley, M., Miller-Ricci, M., & Rumble, M. (2012). Defining twenty-first century skills. In P. Griffin, B. McGaw, and E. Care (Eds.), *Assessment and teaching of 21st century skills* (pp. 17–66). Dordrecht, The Netherlands: Springer.
- Blunsdon, B., Reed, K., McNeil, N., & McEachern, S. (2003). Experiential learning in social science theory: An investigation of the relationship between student enjoyment and learning. *Higher Education Research & Development, 22*(1), 43–56.

- Boekaerts, M. (2001). Context sensitivity: Activated motivational beliefs, current concerns and emotional arousal. In S. Volet & S. Järvelä (Eds.), *Motivation in learning contexts: Theoretical advances and methodological implications* (pp. 17–31). Amsterdam, The Netherlands: Pergamon.
- Boekaerts, M. (2010). The crucial role of motivation and emotion in classroom learning. In H. Dumont, D. Istance, & F. Benavides (Eds.), *The nature of learning: Using research to inspire practice* (pp. 91–108). Paris, France: OECD.
- Bolliger, D. U., & Supanakorn, S. (2011). Learning styles and student perceptions of the use of interactive online tutorials. *British Journal of Educational Technology*, 42(3), 470–481.
- Bouffard-Bouchard, T., Parent, S., & Larivee, S. (1991). Influence of self-efficacy on self-regulation and performance among junior and senior high school age children. *International Journal of Behavioral Development*, 14(2), 153–164.
- Bowlby, J. (1982). *Attachment and loss: Vol.1. Attachment* (2nd ed.). London, UK: Hogarth Press.
- Boz, Y., Yerdelen-Damar, S., Aydemir, N., & Aydemir, M. (2016). Investigating the relationships among students' self-efficacy beliefs, their perceptions of classroom learning environment, gender, and chemistry achievement through structural equation modeling. *Research in Science & Technological Education*, 34(3), 307–324.
- Brady-Amoon, P., & Fuertes, J. N. (2011). Self-efficacy, self-rated abilities, adjustment, and academic performance. *Journal of Counseling & Development*, 89(4), 431–438.
- Brinkman, S., Gregory, T., Harris, J., Hart, B., Blackmore, S., & Janus, M. (2013). Associations between the Early Development Instrument at age 5, and reading and numeracy skills at ages 8, 10 and 12: A prospective linked data study. *Child Indicators Research*, 6(4), 695–708.

- Britner, S. L., & Pajares, F. (2006). Sources of science self-efficacy beliefs of middle school students. *Journal of Research in Science Teaching*, 43(5), 485–499.
- Bronfenbrenner, U. (1979). *The ecology of human development: Experiments by nature and design*. Cambridge, MA: Harvard University Press.
- Broos, A. (2005). Gender and Information and Communication Technologies (ICT) anxiety: Male self-assurance and female hesitation. *Cyber Psychology & Behavior*, 8(1), 21–31.
- Broos, A., & Roe, K. (2006). The digital divide in the playstation generation: Self-efficacy, locus of control and ICT adoption among adolescents. *Poetics*, 34(4-5), 306-317.
- Brophy, J. E. (1983). *Motivating students to learn* (3rd ed.). Hoboken, NJ: Taylor & Francis.
- Brophy, J. E. (1987). Synthesis of research on strategies for motivating students to learn. *Educational Leadership*, 45(2), 40–48.
- Brown, T. A. (2014). *Confirmatory factor analysis for applied research* (2nd ed.). New York, NY: Guilford.
- Bruner, J. (1986). *Actual minds, possible worlds*. Boston, MA: Harvard University Press.
- Bruner, J. (1996). *The culture of education*. Cambridge, MA: Harvard University Press.
- Bryant, D. P., & Bryant, B. (1998). Using assistive technology adaptations to include students with learning disabilities in cooperative learning activities. *Journal of Learning Disabilities*, 31(1), 41–54.

- Buccheri, G., Gürber, N. A., & Brühwiler, C. (2011). The impact of gender on interest in science topics and the choice of scientific and technical vocations. *International Journal of Science Education, 33*(1), 159–178.
- Byrne, E., & Brodie, M. (2012). *Cross-curricular teaching and learning in the secondary school: Science*. New York, NY: Routledge.
- Caplan, R. D. (1987). Person–environment fit theory and organizations: Commensurate dimensions, time perspectives, and mechanisms. *Journal of Vocational Behavior, 31*(3), 248–267.
- Cattell, R. (1961). *Prediction and understanding of the effect of children's interest upon school performance*. University of Illinois.
- Chang, V., & Fisher, D. (2001, May). *The validation and application of a new learning environment instrument to evaluate online learning in higher education*. Paper presented at the Australian Association for Research in Education Conference, Fremantle, Australia.
- Chen, A., & Darst, P. W. (2002). Individual and situational interest: The role of gender and skill. *Contemporary Educational Psychology, 27*(2), 250–269.
- Chen, S, Yang, S. J. H., & Hsiao, C. (2016). Exploring student perceptions, learning outcome and gender differences in a flipped mathematics course. *British Journal of Educational Technology, 47*(6), 1096–1112.
- Cheung, A. C. K., & Slavin, R. E. (2013). The effectiveness of educational technology applications for enhancing mathematics achievement in K–12 classrooms: A meta-analysis. *Educational Research Review, 9*, 88–113.
- Chionh, Y. H., & Fraser, B. J. (2009). Classroom environment, achievement, attitudes and self-esteem in geography and mathematics in Singapore. *International Research in Geographical and Environmental Education, 18*(1), 29–44.

- Chipangura, A. (2014). *Multimedia in high school mathematics classes: Students' perceptions of the learning environment and engagement* (Doctoral thesis). Retrieved from <https://espace.curtin.edu.au/handle/20.500.11937/262>
- Chipangura, A., & Aldridge, J. M. (2017). Impact of multimedia on students' perceptions of the learning environment in mathematics classrooms. *Learning Environments Research*, 20(1), 121–138.
- Chu, R. J. (2010). How family support and internet self-efficacy influence the effects of e-learning among higher aged adults—Analyses of gender and age differences. *Computers & Education*, 55(1), 255–264.
- Clark, R. (1983). Reconsidering research on learning from media. *Review of Educational Research*, 53(4), 445–459.
- Cohen, J. (2013). *Statistical power analysis for the behavioral sciences*. Hoboken, NY: Taylor & Francis.
- Cohen, L., Manion, L., & Morrison, K. (2011). *Research methods in education* (7th ed.). London, UK: Routledge.
- Cohn, S. T., & Fraser, B. J. (2016). Effectiveness of student response systems in terms of learning environment, attitudes and achievement. *Learning Environments Research*, 19(2), 153–167.
- Collins, A., & Halverston, R. (2009). *Rethinking education in the age of technology: The digital revolution of schooling in America*. New York, NY: Teachers College Press.
- Comi, S. L., Argentin, G., Gui, M., Origo, F., & Pagani, L. (2017). Is it the way they use it? Teachers, ICT and student achievement. *Economics of Education Review*, 56(1), 24–39.
- Connell, R. W. (2000). *The men and the boys*. St. Leonards, Australia: Allen & Unwin.

- Creswell, J. W. (2014). *Qualitative, quantitative and mixed methods approaches* (4th ed.). Thousand Oaks, CA: Sage.
- Crosbie-Brunett, M., & Lewis, E. A. (1993). Theoretical contributions from social and cognitive behavioral psychology. In P. G. Boss, W. J. Doherty, R. LaRossa, W. R. Schumm, & S. K. Streinmetz (Eds.), *Sourcebook of family theories and methods: A contextual approach* (pp. 531–557). New York, NY: Plenum Press.
- Csikszentmihalyi, M. (1990). *Flow: The psychology of optimal experience*. New York, NY: Harper-Perennial.
- Csikszentmihalyi, M. (1997). *Finding flow: The psychology of engagement with everyday life*. New York, NY: Basic Books.
- Csikszentmihalyi, M. (2014). *Flow and the foundations of positive psychology: The collected works of Mihaly Csikszentmihalyi*. Claremont, CA: Springer.
- Cuadrado-García, M., Ruiz-Molina, M. E., & Montoro-Pons, J. D. (2010). Are there gender differences in e-learning use and assessment? Evidence from an interuniversity online project in Europe. *Procedia—Social and Behavioral Sciences*, 2(2), 367–371.
- Cunningham, A. E., & Stanovich, K. E. (1997). Early reading acquisition and its relation to reading experience and ability 10 years later. *Developmental Psychology*, 33(6), 934–945.
- Davis, W. (1982). A causal theory of enjoyment. *Mind*, 91(362), 240–256.
- Day, S. L. (2002). Real kids, real risks: Effective instruction of students at risk of failure. *National Association of Secondary School Principals Bulletin*, 86(632), 19–32.
- Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behaviour*. New York, NY: Plenum Press.

- Deci, E. L., & Ryan, R. M. (2000). The “what” and “why” of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry, 11*(4), 227–268.
- DeCorte, E. (2010). Historical developments in the understanding of learning. In H. Dumont, D. Instance, & F. Benavides (Eds.), *The nature of learning: Using research to inspire practice* (pp. 35–68). Paris, France: OECD.
- Demir, S., & Basol, G. (2014). Effectiveness of computer-assisted mathematics education (CAME) over academic achievement: A meta-analysis study. *Educational Sciences: Theory and Practice, 14*(5), 2026–2035.
- Demirtas, H., Comert, M., & Ozer, N. (2011). Pre-service teachers’ self-efficacy beliefs and attitudes towards profession. *Education and Science, 36*(159), 96–111.
- den Brok, P., Fisher, D., Rickards, T., & Bull, E. (2006). Californian science students’ perceptions of their classroom learning environments. *Educational Research and Evaluation, 12*(1), 3–25.
- Dorman, J. P. (2001). Associations between classroom environment and academic efficacy. *Learning Environments Research, 4*(3), 243–257.
- Dorman, J. P. (2002). Classroom environment research: Progress and possibilities. *Queensland Journal of Educational Research, 18*(2), 112–140.
- Dorman, J. P. (2003). Cross-national validation of the What Is Happening In This Class? (WIHIC) questionnaire using confirmatory factor analysis. *Learning Environments Research, 6*(3), 231–245.
- Dorman, J. P. (2008a). Use of multitrait–multimethod modelling to validate actual and preferred forms of the What Is Happening In This Class? (WIHIC) questionnaire. *Learning Environments Research, 11*(3), 179–193.

- Dorman, J. P. (2008b). Using student perceptions to compare actual and preferred classroom environment in Queensland schools, *Educational Studies*, 34(4), 299–308.
- Dorman, J. P., & Fraser, B. J. (2009). Psychological environment and affective outcomes in technology-rich classrooms: Testing a causal model. *Social Psychology of Education*, 12(1), 77–99.
- Duignan, P. (2012). *Educational leadership: Together creating ethical learning environments* (2nd ed.). Cambridge University Press.
- Dumont, H., & Istance, D. (2010). Analysing and designing learning environments for the 21st century. In H. Dumont, D. Istance, & F. Benavides (Eds.), *The nature of learning: Using research to inspire practice* (pp. 19–32). Paris, France: OECD.
- Dumont, H., Istance, D., & Benavides, F. (Eds.). (2010). *The nature of learning: Using research to inspire practice*. Paris, France: OECD.
- Dunn, P., & Marinetti, A. (2008). Beyond localization: Effective learning strategies for cross-cultural e-learning. In H. Rahman (Ed.), *Developing successful ICT strategies: Competitive advantages in a global knowledge-driven society* (pp. 155-164). Hershey, PA: IGI Global.
- Durndell, A., & Haag, Z. (2002). Computer self-efficacy, computer anxiety, attitudes towards the Internet and reported experience with the Internet, by gender, in an East European sample. *Computers in Human Behavior*, 18(5), 521–535.
- Dweck, C. S. (2013). *Self-theories: Their role in motivation, personality, and development*. Hoboken, NJ: Taylor & Francis.
- Earl, L. M. (2003). *Assessment as learning: Using classroom assessment to maximize student learning*. Thousand Oaks, CA: Corwin Press.

- Eccles, J. S. (1983). Expectancies, values, and academic behaviors. In J. T. Spence (Ed.), *Achievement and achievement motives: Psychological and sociological approaches* (pp. 75–146). San Francisco, CA: W. H. Freeman.
- Eccles, J. S., & Wigfield, A. (2002). Motivational beliefs, values and goals. *Annual Review of Psychology*, *53*(1), 109–132.
- Eccles, J. S., Wigfield, A., & Schiefele, U. (1998). Motivation to succeed. *Handbook of Child Psychology*, *3*(5), 1017–1095.
- Echazarra, A., Salinas, D., Méndez, I., Denis, V., Rech, G. (2016). *How teachers teach and students learn: Successful strategies for school*. Paris, France: OECD.
- Elliot, A. J., & Dweck, C. S. (2013). *Handbook of competence and motivation*. New York, NY: Guilford.
- Elliott, J. G., Hufton, N. R., Willis, W., & Illushin, L. (2005). *Motivation, engagement and educational performance: International perspectives on the contexts for learning*. New York, NY: Palgrave Macmillan.
- Encyclopaedia Britannica. (2018). *Western Australia*. Retrieved from <https://www.britannica.com/place/Western-Australia>
- Farkas, G., Grobe, R. P., Sheehan, D., & Shuan, Y. (1990). Cultural resources and school success: Gender, ethnicity, and poverty groups within an urban school district. *American Sociological Review*, *55*(1), 127–142.
- Ferguson, P. D., & Fraser, B. J. (1999). Changes in learning environment during the transition from primary to secondary school. *Learning Environments Research*, *1*(3), 369–383.
- Field, A. (2009). *Discovering statistics using SPSS* (3rd ed.). London, UK: Sage.
- Fink, A. (2003). *The survey kit: How to sample in surveys*. London, UK: Sage.

- Finn, J. D., Pannozzo, G. M., & Voelkl, K. E. (1995). Disruptive and inattentive-withdrawn behavior and achievement among fourth graders. *Elementary School Journal, 95*(5), 421–434.
- Finn, J. D., & Rock, D. (1997). Academic success among students at risk for school failure. *Journal of Applied Psychology, 82*(2), 221–234.
- Fischer, F., Schult, J., & Hell, B. (2012). Sex differences in secondary school success: Why female students perform better. *European Journal of Psychology Education, 28*(2), 529–543.
- Fisher, C. B. (2005). Deception research involving children: Ethical practices and paradoxes. *Ethics & Behavior, 15*(3), 271–287.
- Fisher, D. L., & Fraser, B. J. (1981). Validity and use of the My Class Inventory. *Science Education, 65*(2), 145–156.
- Fisher, D. L., Fraser, B., & Cresswell, J. (1995). Using the “Questionnaire on Teacher Interaction” in the professional development of teachers. *Australian Journal of Teacher Education, 20*(1), 8–19.
- Fisher, D. L., Henderson, D., & Fraser, B. J. (1995). Interpersonal behaviour in senior high school biology classes. *Research in Science Education, 25*(2), 125–133.
- Fisher, T., Denning, T., Higgins, C., & Loveless, A. (2012). Teachers’ knowing how to use technology: Exploring a conceptual framework for purposeful learning activity. *Curriculum Journal, 23*(3), 307–325.
- Fowler, F. J. (2009). *Survey research methods* (4th ed.). Thousand Oaks, CA: Sage.
- Frailon, J., Ainley, J., Schultz, W., Friedman, T., & Gebhardt, E. (2014). *Preparing for life in a digital age—The IEA International Computer and Information Literacy Study International Report*. Heidelberg, Germany: Springer.

- Fraser, B. J. (1978). Development of a test of science-related attitudes. *Science Education*, 62(4), 509–515.
- Fraser, B. J. (1982). Differences between student and teacher perceptions of actual and preferred classroom learning environment. *Educational Evaluation and Policy Analysis*, 4(4), 511–519.
- Fraser, B. J. (1989). Twenty years of classroom climate work: Progress and prospect. *Journal of Curriculum Studies*, 21(4), 307–327.
- Fraser, B. J. (1994). Research on classroom and school climate. In D. Gabel (Ed.), *Handbook of research on science teaching and learning* (pp. 492–541). New York, NY: Macmillan.
- Fraser, B. J. (1998a). Classroom environment instruments: Development, validity and applications. *Learning Environments Research*, 1(1), 7–34.
- Fraser, B. J. (1998b). Science learning environments: Assessment, effects and determinants. In B. J. Fraser & K. G. Tobin (Eds.), *The international handbook of science education* (pp. 527–564). Dordrecht, The Netherlands: Kluwer Academic.
- Fraser, B. J. (2001). Twenty thousand hours: Editor's introduction. *Learning Environments Research*, 4(1), 1–5.
- Fraser, B. J. (2003). Preface. In M. S. Khine & D. L. Fisher (Eds.), *Technology-rich learning environments: A future perspective*. Singapore: World Scientific.
- Fraser, B. J. (2007). Classroom learning environments. In S. K. Abell & N. G. Lederman (Eds.), *Handbook of research on science education* (pp. 103–124). Mahwah, NJ: Lawrence Erlbaum.
- Fraser, B. J. (2012a). *Classroom environment*. Hoboken, NJ: Taylor & Francis.

- Fraser, B. J. (2012b). Classroom environment instruments: Development, validity and applications. *Learning Environments Research*, 1(1), 7–33.
- Fraser, B. J. (2012c). Classroom learning environments: Retrospect, context and prospect. In B. J. Fraser, K. G. Tobin, & C. J. McRobbie (Eds.), *Second international handbook of science education* (pp. 1191–1239). New York, NY: Springer.
- Fraser, B. J., Aldridge, J. M., & Adolphe, F. S. G. (2010). A cross-national study of secondary science classroom environments in Australia and Indonesia. *Research in Science Education*, 40(4), 551–571.
- Fraser, B. J., Anderson, G. J., & Walberg, H. J. (1982). *Assessment of learning environments: Manual for Learning Environment Inventory (LEI) and My Class Inventory (MCI)* (3rd ed.). Western Australian Institute of Technology.
- Fraser, B. J., & Fisher, D. L. (1982). Effects of classroom psychosocial environment on student learning. *British Journal of Educational Psychology*, 52(3), 374–377.
- Fraser, B. J., & Fisher, D. L. (1983a). Development and validation of short forms of some instruments measuring student perceptions of actual and preferred classroom learning environment. *Science Education*, 67(1), 115–131.
- Fraser, B. J., & Fisher, D. L. (1983b). Student achievement as a function of person–environment fit: A regression surface analysis. *British Journal of Educational Psychology*, 53(1), 89–99.
- Fraser, B. J., & Fisher, D. L. (1983c). Use of actual and preferred classroom environment scales in person–environment fit research. *Journal of Educational Psychology*, 75(2), 303–313.
- Fraser, B. J., Giddings, G. J., & McRobbie, C. J. (1995). Evolution and validation of a personal form of an instrument for assessing science laboratory classroom environments. *Journal of Research in Science Teaching*, 32(4), 399–422.

- Fraser, B. J., McRobbie, C. J., & Fisher, D. L. (1996, April). *Development, validation, and use of personal and class forms of a new classroom environment instrument*. Paper presented at the annual meeting of the American Educational Research Association, New York, NY.
- Fraser, B. J., & O'Brien, P. (1985). Student and teacher perceptions of the environment of elementary school classrooms. *Elementary School Journal*, *85*(5), 567–580.
- Fraser, B. J., & Rentoul, A. J. (1980). Person–environment fit in open classrooms. *Journal of Educational Research*, *73*(3), 159–167.
- Fraser, B. J., & Treagust, D. F. (1986). Validity and use of an instrument for assessing classroom psychosocial environment in higher education. *Higher Education*, *15*(1), 37–57.
- Fraser, B. J., Treagust, D. F., & Dennis, N. C. (1986). Development of an instrument for assessing classroom psychosocial environment at universities and colleges. *Studies in Higher Education*, *11*(1), 43–54.
- Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of Educational Research*, *74*(1), 59–109.
- Fredrickson, B. L. (2001). Role of positive emotions in positive psychology. *American Psychologist*, *56*(3), 218–226.
- French, J. R. P., Caplan, R. D., & Harrison, R. (1982). *The mechanisms of job stress and strain*. New York, NY: Wiley.
- Frenzel, A. C., Goetz, T., Ludtke, O., Pekrun, R., & Sutton, R. E. (2009). Emotional transmission in the classroom: Exploring the relationship between teacher and student enjoyment. *Journal of Educational Psychology*, *101*(3), 705–716.

- Frenzel, A. C., Goetz, T., Pekrun, R., & Watt, H. M. G. (2010). Development of mathematics interest in adolescence: Influences of gender, family, and school context. *Journal of Research on Adolescence, 20*(2), 507–537.
- Frey, C. B., & Osborne, M. A. (2017). The future of employment: How susceptible are jobs to computerisation? *Technological Forecasting and Social Change, 114*(1), 254–280.
- Fullan, M. (2011). *Choosing the wrong drivers for whole system reform*. Melbourne, Australia: Centre for Strategic Education.
- Fullan, M. (2012). *Stratosphere: Integrating technology, pedagogy and change knowledge*. Toronto, Canada: Pearson.
- Fullan, M., & Donnelly, K. (2013) *Alive in the swamp: Assessing digital innovations in education*. London, UK: Nesta.
- Gagné, R. M., & Driscoll, M. P. (1975). *Essentials of learning for instruction*. Hinsdale, IL: Dryden Press.
- Gagné, R. M. (1985). *The conditions of learning* (4th ed.). New York, NY: Holt, Rinehart & Winston.
- Galloway, D., Rogers, C., Armstrong, D., & Leo, E. (1998). *Motivating the difficult to teach*. London, UK: Longman.
- Galyon, C. E., Blondin, C. A., Yaw, J. S., Nalls, M. L., & Williams, R. L. (2012). The relationship of academic self-efficacy to class participation and exam performance. *Social Psychology of Education, 15*(2), 233–249.
- Gardner, P. L. (1975). Projection effects and the needs–press model. *Journal of Social Psychology, 95*(1), 91–97.
- Gillespie, H. (2006). *Unlocking learning and teaching with ICT: Identifying and overcoming barriers*. London, UK: David Fulton.

- Ginott, H. G. (1971). *Teacher and child*. New York, NY: Macmillan.
- Glynn, S. M., Taasobshirazi, G., & Brickman, P. (2009). Science Motivation Questionnaire: Construct validation with nonscience majors. *Journal of Research in Science Teaching*, 46(2), 127–146.
- Goh, S. C., & Fraser, B. J. (1996). Validation of an elementary school version of the Questionnaire on Teacher Interaction. *Psychological Reports*, 79(5), 512–522.
- Goh, S. C., & Fraser, B. J. (1998). Teacher interpersonal behaviour, classroom environment and student outcomes in primary mathematics in Singapore. *Learning Environments Research*, 1(2), 199–229.
- Goh, S. C., Young, D. J., & Fraser, B. J. (1995). Psychosocial climate and student outcomes in elementary mathematics classrooms: A multilevel analysis. *Journal of Experimental Education*, 64(1), 29–40.
- Goldbaum, S., Craig, W. M., Pepler, D., & Connolly, J. (2003). Developmental trajectories of victimization: Identifying risk and protective factors. *Journal of Applied School Psychology*, 19(2), 139–156.
- Gomez, E. A., Wu, D., & Passerini, K. (2010). Computer-supported team-based learning: The impact of motivation, enjoyment and team contributions on learning outcomes. *Computers & Education*, 55(1), 378–390.
- González-Gómez, F., Guardiola, J., Rodríguez, Ó. M., & Alonso, M. Á. M. (2012). Gender differences in e-learning satisfaction. *Computers & Education*, 5(1), 283–290.
- Goodenow, C. (1993). Classroom belonging among early adolescent students: Relationships to motivation and achievement. *Journal of Early Adolescence*, 13(1), 21–43.

- Gore, P. A., Jr. (2006). Academic self-efficacy as a predictor of college outcomes: Two incremental validity studies. *Journal of Career Assessment*, 14(1), 92–115.
- Gottfried, A. E., Fleming, J. S., & Gottfried, A. W. (2001). Continuity of academic intrinsic motivation from childhood through late adolescence: A longitudinal study. *Journal of Educational Psychology*, 93(1), 3–13.
- Griffin, P., Care, E., & McGaw, B. (2012). The changing role of education and schools. In P. Griffin, B. McGaw, and E. Care (Eds.), *Assessment and teaching of 21st century skills* (pp. 1–15). Dordrecht, Germany: Springer.
- Gross, M. U. M., MacLeod, B. M., & Pretorius, M. (2001). *Gifted students in secondary schools: Differentiating the curriculum* (2nd ed.). Sydney, Australia: University of New South Wales.
- Gurian, M. (2011). *Boys and girls learn differently: A guide for teachers and parents*. San Francisco, CA: Jossey Bass.
- Haertel, G., Walberg, H., & Haertel, E. (1981). Socio-psychological environments and learning: A quantitative synthesis. *British Educational Research Journal*, 7(1), 27–36.
- Hall, T. E., Cohen, N., Vue, G., & Ganley, P. (2015). Addressing learning disabilities with UDL and technology: Strategic reader. *Learning Disability Quarterly*, 38(2), 72–83.
- Hannover, B., & Kessels, U. (2006). How the image of maths and science affects the development of academic interests. In M. Prenzel (Ed.), *Studies on the educational quality of schools* (pp. 283–297). Münster, Germany: Waxmann.
- Hargittai, E., & Hinnant, A. (2008). Digital inequality: Differences in young adults' use of the internet. *Communication Research*, 35(5), 602–621.

- Hasan, M. N. (2016). Positivism: To what extent does it aid our understanding of the contemporary social world? *Quality and Quantity*, 50(1), 317–325.
- Hastings, R. P., Hewes, A., Lock, S., & Witting, A. (1996). Do special educational needs courses have any impact on student teachers' perceptions of children with severe learning difficulties? *British Journal of Special Education*, 23(3), 139–144.
- Hatlevik, O. E., Ottestad, G., & Throndsen, I. (2015). Predictors of digital competence in 7th grade: A multilevel analysis. *Journal of Computer Assisted Learning*, 31(3), 220–231.
- Hattie, J. A. C. (2009). *Visible learning: A synthesis of 800+ meta-analyses on achievement*. London, UK: Routledge.
- Hattie, J. A. C. (2012). *Visible learning for teachers: Maximizing impact on learning*. London, UK: Routledge.
- Helf, S., Cooke, N., & Flowers, C. (2009). Effects of two grouping conditions on students who are at-risk for reading failure. *Preventing School Failure*, 53(2), 113–128.
- Hen, M., & Goroshit, M. (2012). Academic procrastination, emotional intelligence, academic self-efficacy, and GPA: A comparison between students with and without learning disabilities. *Journal of Learning Disabilities*, 47(2), 116–124.
- Henderson, D., Fisher, D. L., & Fraser, B. J. (2000). Interpersonal behaviour, laboratory learning environments and student outcomes in senior biology classes. *Journal of Research in Science Teaching*, 37(1), 26–43.
- Henderson, K. A. (2011). Post-positivism and the pragmatics of leisure research. *Leisure Sciences*, 33(4), 341–346.

- Herrington, J., & Oliver, R. (2000). An instructional design framework for authentic learning environments. *Educational Technology Research and Development, 48*(3), 23–48.
- Hidi, S., & Renninger, K. A. (2006). The four-phase model of interest development. *Educational Psychologist, 41*(2), 111–127.
- Hollingsworth, J., & Ybarra, S. (2009). *Explicit Direct Instruction (EDI): The power of the well-crafted, well-taught lesson*. Fowler, CA: Corwin Press.
- Huang, C. (2013). Gender differences in academic self-efficacy: A meta-analysis. *European Journal of Psychology of Education, 28*(1), 1–35.
- Hubber, P., & Loong, E. (2013). Increasing learner engagement of learning technologies and science TPACK through representational challenges. *Cutting-Edge Technologies in Higher Education, 6*, 83–112.
- Hung, M. L., Chou, C., Chen, C. H., & Own, Z. Y. (2010). Learner readiness for online learning: Scale development and student perceptions. *Computers & Education, 55*(3), 1080–1090.
- Hunt, N., & Marshall, K. (2002). *Exceptional children and youth* (3rd ed.). Boston, MA: Houghton Mifflin.
- Jha, N. K. (2008). *Research methodology*. Chandigarh, India: Abhishek Publications.
- Jinks, J., & Morgan, V. (1999). Children's perceived academic self-efficacy: An inventory scale. *Clearing House, 72*(4), 224–230.
- Johnson, D. W., Johnson, R. T., & Smith, K. (2007). The state of cooperative learning in postsecondary and professional settings. *Educational Psychology Review, 19*(1), 15–29.
- Jones, E. (2011). The technology-boom. *School Matters, 2*, 18–20.

- Jones, S. M., & Dindia, K. (2004). A meta-analytic perspective on sex equity in the classroom. *Review of Educational Research, 74*(4), 443–471.
- Joyce, H. D., & Early, T. J. (2014). The impact of school connectedness and teacher support on depressive symptoms in adolescents: A multilevel analysis. *Children and Youth Services Review, 39*, 101–107.
- Jukes, I., McCain, T., & Crockett, L. (2010). *Living on the future edge: Windows on tomorrow*. Kelowna, Canada: Corwin Press.
- Jukes, I., McCain, T., & Crockett, L. (2011). *Understanding the digital generation: Teaching and learning in the new digital landscape*. Kelowna, Canada: Corwin Press.
- Kaiser, H. F. (1960). The application of electronic computers to factor analysis. *Educational and Psychological Measurement, 20*(1), 141–151.
- Kaiser, H. F. (1974). An index of factorial simplicity. *Psychometrika, 39*(1), 31–36.
- Kavkler, M., Babuder, M. K., & Magajna, L. (2015). Inclusive education for children with specific learning difficulties: Analysis of opportunities and barriers in inclusive education in Slovenia. *Center for Educational Policy Studies Journal, 5*(1), 31–52.
- Kaya, E., Ozay, E., & Sezek, F. (2008). Application of a questionnaire to describe teacher–students communication behaviour in a university in Turkey. *International Journal of Environmental and Science Education, 3*(1), 26–29.
- Keddie, A., & Mills, M. (2011). Teaching boys: Developing classroom practices that work. *Redress, 20*(1), 24–27.
- Kennedy, M. J., & Deshler, D. D. (2010). Literacy instruction, technology, and students with learning disabilities: Research we have, research we need. *Learning Disability Quarterly, 33*(4), 289–298.

- Khoo, H. S., & Fraser, B. J. (2008). Using classroom psychosocial environment in the evaluation of adult computer application courses in Singapore. *Technology, Pedagogy and Education, 17*(1), 53–67.
- Kidd, T. T., & Keengwe, J. (2012). Technology integration and urban schools: Implications for instructional practices. In L. Tomei (Ed.), *Advancing education with information communication technologies: Facilitating new trends* (pp. 244–256). Hershey, PA: IGI Global.
- Kidger, J., Araya, R., Donovan, J., & Gunnell, D. (2012). The effect of the school environment on the emotional health of adolescents: A systematic review. *Paediatrics, 129*(5), 925–943,
- Killen, R. (2000). *Outcomes-based education: Principles and possibilities*. Retrieved from <http://drjj.uitm.edu.my/DRJJ/CONFERENCE/UPSI/OBEKillen.pdf>
- Kim, H. B., Fisher, D. L., & Fraser, B. J. (2000). Classroom environment and teacher interpersonal behaviour in secondary science classes in Korea. *Evaluation and Research in Education, 14*(1), 3–22.
- Kim, H. S., Kil, H. J., & Shin, A. (2014). An analysis of variables affecting the ICT literacy level of Korean elementary school students. *Computers & Education, 77*, 29–38.
- Kim, J., & Mueller, C. W. (1982). *Introduction to factor analysis: What it is and how to do it*. Beverly Hills, CA: Sage.
- Kiran, D., & Sungur, S. (2012). Middle school students' science self-efficacy and its sources: Examination of gender difference. *Journal of Science Education and Technology, 21*(5), 619–630.
- Klassen, R. M. (2010). Confidence to manage learning: The self-efficacy for self-regulated learning of early adolescents with learning disabilities. *Learning Disability Quarterly, 33*(1), 19–30.

- Klem, A. M., & Connell, J. P. (2004). Relationships matter: Linking teacher support to student engagement and achievement. *Journal of School Health, 74*(7), 262–273.
- Klenowski, V., & Wyatt-Smith, C. (2010). Standards, teacher judgement and moderation in contexts of national curriculum and assessment reform. *Assessment Matters, 2*, 107–131.
- Koh, N. K., & Fraser, B. J. (2014). Learning environment associated with use of mixed mode delivery model among secondary business studies students in Singapore. *Learning Environments Research, 17*(2), 157–171.
- Koul, R. B., & Fisher, D. L. (2005). Cultural background and students' perceptions of science classroom learning environment and teacher interpersonal behaviour in Jammu, India. *Learning Environments Research, 8*(2), 195–211.
- Koul, R. B., Fisher, D. L., & Shaw, T. (2011). An application of the TROFLEI in secondary-school science classes in New Zealand. *Research in Science & Technological Education, 29*(2), 147–167.
- Kulik, J. (2003). *Effects of using instructional technology in elementary and secondary schools: What controlled evaluation studies say*. Arlington, VA: SRI International.
- Laal, M. (2013). Collaborative learning: Elements. *Procedia—Social and Behavioral Sciences, 83*, 814–818.
- Lackaye, T., Margalit, M., Ziv, O., & Ziman, T. (2006). Comparisons of self-efficacy, mood, effort, and hope between students with learning disabilities and their non-LD-matched peers. *Learning Disabilities Research & Practice, 21*(2), 111–121.
- Laerd Statistics (n.d.). One-way MANOVA in SPSS Statistics. Retrieved from <https://statistics.laerd.com/spss-tutorials/one-way-manova-using-spss-statistics.php>

- Lagana-Riordan, C., Aguilar, J. P., Franklin, C., Streeter, C. L., Kim, J. S., Tripodi, S. J., & Hopson, L. M. (2011). At-risk students' perceptions of traditional schools and a solution-focused public alternative school. *Preventing School Failure, 55*(3), 105–114.
- Lai, H., Chou, W., Miao, N., Wu, Y., Lee, P., & Jwo, J. (2015). A comparison of actual and preferred classroom environments as perceived by middle school students. *Journal of School Health, 85*(6), 388–397.
- Lamborn, S. D., Brown, B. B., Mounts, N. S., & Steinberg, L. (1992). Putting school in perspective: The influence of family, peers, extracurricular participation, and part-time work on academic engagement. In E. M. Newmann (Ed.), *Student engagement and achievement in American secondary schools* (pp. 153–181). New York, NY: Teachers College Press.
- Laosethakul, K., Leingpibul, T., & Coe, T. (2012). Investigation into gender perception toward computing: A comparison between the U.S. and India. In L. Tomei (Ed.), *Advancing education with information communication technologies: Facilitating new trends* (pp. 305–319). Hershey, PA: IGI Global.
- Lee, Y., Lee, J., & Hwang, Y. (2015). Relating motivation to information and communication technology. *Computers in Human Behavior, 51*(1), 418–428.
- Leonard, L. N., & Manly, T. S. (2011). Social networks and students' ethical behavior. In M. Quigley (Ed.), *ICT ethics and security in the 21st century: New developments and applications* (pp. 27–45). Hershey, PA: IGI Global.
- Lerdpornkulrat, T., Koul, R., & Poondej, C. (2018). Relationship between perceptions of classroom climate and institutional goal structures and student motivation, engagement and intention to persist in college. *Journal of Further and Higher Education, 42*(1), 102–115.
- Lewin, K. (1936). *Principles of topological psychology*. New York, NY: McGraw.

- Leye, S., Himmelspach, J., & Uhrmacher, A. M. (2009). A discussion on experimental model validation. In D. Al-Dabass, A. Orsoni, A. Brentnall, A. Abraham, and R. Zobel. *Eleventh International Conference on Computer Modelling and Simulation* (pp. 161–167). Cambridge, UK: Institute of Electrical and Electronics Engineers Computer Society.
- Li, X., & Sireci, S. G. (2013). A new method for analyzing content validity data using multidimensional scaling. *Educational and Psychological Measurement*, 73(3), 365–385.
- Lim, T. K. (1995). Perceptions of classroom environment, school types, gender and learning styles of secondary school students. *Educational Psychology*, 15(2), 161–169.
- Lindberg, S. M., Hyde, J. S., Petersen, J. L., & Linn, M. C. (2010). New trends in gender and mathematics performance: A meta-analysis. *Psychological Bulletin*, 136(6), 1123–1135.
- Linnenbrink, E. A. (2006). Emotion research in education: Theoretical and methodological perspectives on the integration of affect, motivation, and cognition. *Educational Psychology Review*, 18(4), 307–314.
- Lopez, M. (2012). *Measurement of challenge and self-efficacy in learning* (Doctoral thesis). Retrieved from <https://espace.curtin.edu.au/handle/20.500.11937/1864>
- Lorsbach, A., & Jinks, J. (1999). Self-efficacy theory and learning environment research. *Learning Environments Research* 2(2), 157–167.
- Louden, W., Chan, L., Elkins, J., & Greaves, D. (2000). *Mapping the territory—Primary students with learning difficulties: Literacy and numeracy*. Canberra, Australia: Department of Education, Employment and Workplace Relations.

- Louis, R., & Mistele, J. (2011). The differences in scores and self-efficacy by student gender in mathematics and science. *International Journal of Mathematics and Science Education, 10*(5), 1163–1190.
- Loukas, A., & Robinson, S. (2004). Examining the moderating role of perceived school climate in early adolescent adjustment. *Journal of Research on Adolescence, 14*(2), 209–233.
- Lu, H., & Chiou, M. (2010). The impact of individual differences on e-learning system satisfaction: A contingency approach. *British Journal of Educational Technology, 41*(2), 307–323.
- Lumby, J. (2011). Enjoyment and learning: Policy and secondary school learners' experience in England. *British Educational Research Journal, 37*(2), 247–264.
- Lumby, J. (2012). Disengaged and disaffected young people: Surviving the system. *British Educational Research Journal, 38*(2), 261–279.
- Luu, K., & Freeman, J. G. (2011). An analysis of the relationship between information and communication technology (ICT) and scientific literacy in Canada and Australia. *Computers & Education, 56*(4), 1072–1082.
- MacLeod, C., & Fraser, B. J. (2010). Development, validation and application of a modified Arabic translation of the What Is Happening In this Class? (WIHIC) questionnaire. *Learning Environments Research, 13*(2), 105–125.
- Magen-Nagar, N., & Steinberger, P. (2017). Characteristics of an innovative learning environment according to students' perceptions: Actual versus preferred. *Learning Environments Research, 20*(3), 307–323.
- Magolda, P. (2006). Critical fusion—Technology and equity in secondary education. *AACE Journal, 14*(3), 287–311.

- Maharaj-Sharma, R., Sharma, A., & Sharma, A. (2017). Using ICT-based instructional technologies to teach science: Perspectives from teachers in Trinidad and Tobago. *Australian Journal of Teacher Education*, 42(10), 23–35.
- Maiano, C., Therme, T., & Mestre, D. (2011). Affective, anxiety and behavioral effects of an aversive stimulation during a simulated navigation task within a virtual environment: A pilot study. *Computers in Human Behavior*, 27(1), 169–175.
- Majeed, A., Fraser, B. J., & Aldridge, J. M. (2002). Learning environment and its association with student satisfaction among mathematics students in Brunei Darussalam. *Learning Environments Research*, 5(2), 203–226.
- Maor, D., & Fraser, B. J. (1996). Use of classroom environment perceptions in evaluating inquiry-based computer assisted learning. *International Journal of Science Education*, 18(4), 401–421.
- Marchand, G., & Skinner, E. (2007). Motivational dynamics of children's academic help seeking and concealment. *Journal of Educational Psychology*, 99(1), 65–82.
- Mariani, M., Villares, E., Christopher, A. S., Colvin, K., & Summer, P. K. (2015). Confirming the structural validity of the My Class Inventory: Short form revised. *Professional School Counseling*, 19(1), 92–102.
- Marshall, M. N. (1996). Sampling for qualitative research. *Family Practice*, 13(6), 522–525.
- Martin-Dunlop, C., & Fraser, B. J. (2008). Learning environment and attitudes associated with an innovative science course designed for prospective elementary teachers. *International Journal of Science and Mathematics Education*, 6(1), 163–190.

- Maxwell, J. A. (2009). Designing a qualitative study. In L. Bickman & D. J. Rog (Eds.), *The SAGE handbook of applied social research methods* (2nd ed., pp. 214–253). Thousand Oaks, CA: Sage.
- McDonald, T. (2013). *Classroom management: Engaging students in learning* (2nd ed.). Sydney, Australia: Oxford University Press.
- McFadden, A. C., Marsh, G. E., Price, B. J., & Hwang, Y. (1992). A study of race and gender bias in the punishment of school children. *Education and Treatment of Children, 15*(2), 140–146.
- Mentor, D. (2015). From app attack to goal-oriented tablet use. In H. An, S. Alon, & D. Fuentes (Eds.), *Tablets in K–12 education: Integrated experiences and implications* (pp. 1–21). Hershey, PA: IGI Global.
- Mettas, A., Karmiotis, I., & Christoforou, P. (2006). Relationship between students' self-beliefs and attitudes on science achievements in Cyprus: Findings from the Third International Mathematics and Science Study (TIMSS). *Eurasia Journal of Mathematics, Science & Technology Education, 2*(1), 41–52.
- Meyer, D. K., & Turner, J. C. (2007). Scaffolding emotions in classrooms. In P. A. Schutz & R. Pekrun (Eds.), *Emotion in education* (pp. 243–258). Amsterdam, The Netherlands: Elsevier.
- Midgley, C. (2002). *Goals, goal structures, and patterns of adaptive learning*. Mahwah, NJ: Lawrence Erlbaum.
- Midgley, C., Kaplan, A., Middleton, M., & Maehr, M. L. (1998). The development and validation of scales assessing students' achievement goal orientations. *Contemporary Education Psychology, 23*(2), 113–131.
- Midgley, C., Maehr, M. L., Hicks, L., Roeser, R., Urdan, T., Anderman, E., & Kaplan, A. (1996). *The Patterns of Adaptive Learning Survey (PALS)*. University of Michigan.

- Miller, P. H., Slawinski Blessing, J., & Schwartz, S. (2006). Gender differences in high-school students' views about science. *International Journal of Science Education, 28*(4), 363–381.
- Milner, H. R. (2010). What does teacher education have to do with teaching? Implications for diversity studies. *Journal of Teacher Education, 61*(1–2), 118–131.
- Milner, H. R. (2014). Culturally relevant, purpose-driven learning and teaching in a middle school social studies classroom. *Multicultural Education, 21*(2), 9–17.
- Mitev, H., & Crowther, D. (2008). Disintermediated education. In H. Rahman (Ed.), *Developing successful ICT strategies: Competitive advantages in a global knowledge-driven society* (pp. 114–132). Hershey, PA: IGI Global.
- Mohammad-Davoudi, A. H., & Parpouchi, A. (2016). Relation between team motivation, enjoyment, and cooperation and learning results in learning area based on team-based learning among students of Tehran University of Medical Science. *Procedia—Social and Behavioral Sciences, 230*, 184–189.
- Moos, R. H. (1973). Changing the social milieu of psychiatric treatment settings. *Journal of Applied Behavioral Science, 9*(5), 575–593.
- Moos, R. H. (1974). *The social climate scales: An overview*. Palo Alto, CA: Consulting Psychologists Press.
- Moos, R. H. (1979). *Evaluating educational environments: Procedures, measures, findings, and policy implications*. San Francisco, CA: Jossey-Bass.
- Moos, R. H. (1980). Evaluating classroom learning environments. *Studies in Educational Evaluation, 6*(3), 239–252.

- Moos, R. H., & Moos, B. S. (1978). Classroom social climate and student absences and grades. *Journal of Educational Psychology, 70*(2), 263–269.
- Moos, R. H., & Trickett, E. J. (1974). *Classroom environment scale manual*. Palo Alto, CA: Consulting Psychologists Press.
- Multon, K. D., Brown, S. D., & Lent, R. W. (1991). Relation of self-efficacy beliefs to academic outcomes: A meta-analytic investigation. *Journal of Counseling Psychology, 30*(1), 30–38.
- Murray, H. A. (1938). *Explorations in personality*. New York, NY: Oxford University Press.
- Nakamura, J., & Csikszentmihalyi, M. (2002). The concept of flow. In C. R. Snyder & S. J. Lopez (Eds.), *Handbook of positive psychology* (pp. 89–105). Oxford University Press.
- Nelson, P. M., Ysseldyke, J. E., & Christ, T. J. (2015). Student perceptions of the classroom environment: Actionable feedback to guide core instruction. *Assessment for Effective Intervention, 41*(1), 16–27.
- Noddings, N. (1996). *Learning to care and be cared for*. Westport, CT: Praeger.
- Obach, M. S. (2003). A longitudinal–sequential study of perceived academic competence and motivational beliefs for learning among children in middle school. *Educational Psychology, 23*(3), 323–338.
- Ogbuehi, P. I., & Fraser, B. J. (2007). Learning environment, attitudes and conceptual development associated with innovative strategies in middle-school mathematics. *Learning Environments Research, 10*(2), 101–114.
- Ong, C. S., & Lai, J. Y. (2006). Gender differences in perceptions and relationships among dominants of e-learning acceptance. *Computers in Human Behavior, 22*(5), 816–829.

- O'Reilly, C. A., Chatman, J., & Caldwell, D. F. (1991). People and organizational culture: A profile comparison approach to assessing person–organization fit. *Academy of Management Journal*, 34(3), 487–516.
- Organisation for Economic Co-Operation and Development [OECD]. (2015). *Students, computers and learning: Making the connection*. Paris, France: Author.
- Owens, K. (2005). Substantive communication of space mathematics in upper primary school. In H. L. Chick & J. I. Vincent (Eds.), *Proceedings of the 29th annual conference of the international group for the psychology of mathematics education* (Vol. 4, pp. 33–40). Melbourne, Australia: Psychology of Mathematics Education.
- Ozdemir, M. (2015). Practices and attitudes of students and teachers using iPads in high school mathematics classes. In H. An, S. Alon, & D. Fuentes (Eds.), *Tablets in K–12 education: Integrated experiences and implications* (pp. 262–277). Hershey, PA: IGI Global.
- Pajares, F. (2006). Self-efficacy during childhood and adolescence: Implications for teachers and parents. In F. Pajares & T. Urdan (Eds.), *Self-efficacy beliefs of adolescents* (pp. 339–367). Greenwich, CT: Information Age.
- Pajares, F., & Miller, M. D. (1994). Role of self-efficacy and self-concept beliefs in mathematical problem solving: A path analysis. *Journal of Educational Psychology*, 86(2), 193–203.
- Pajares, F., & Schunk, D. H. (2001). Self-beliefs and school success: Self-efficacy, self-concept and school achievement. In R. Riding and S. Rayner (Eds.), *Perception* (pp. 239–266). London, UK: Ablex.
- Pallant, J. (2011). *SPSS survival manual: A step by step guide to data analysis using SPSS* (4th ed.). Crows Nest, Australia: Allen & Unwin.

- Paris, S. G., & Turner, J. C. (1994). Situated motivation. In P. Pintrich, D. Brown & C. E. Weinstein (Eds.), *Student motivation, cognition, and learning* (pp. 213–237). Hillsdale, NJ: Erlbaum.
- Park, S. (2017). Analysis of time-on-task, behavior experiences, and performance in two online courses with different authentic learning tasks. *International Review of Research in Open and Distributed Learning*, 18(2), 213–223.
- Park, S., Stone, S. I., & Holloway, S. D. (2017). School-based parental involvement as a predictor of achievement and school learning environment: An elementary school-level analysis. *Children and Youth Services Review*, 82, 195–206.
- Parsons, S. A., & Ward, A. E. (2011). The case for authentic tasks in content literacy. *The Reading Teacher*, 64(6), 462–465.
- Pastorelli, C., Caprara, G. V., Barbaranelli, C., Rola, J., Rozsa, S., & Bandura, A. (2001). The structure of children's perceived self-efficacy: A cross-national study. *European Journal of Psychological Assessment*, 17(2), 87–97.
- Pearson, J. (2006). Investigating ICT using problem-based learning in face-to-face and online learning environments. *Computers and Education*, 47(1), 56–73.
- Pearson, P. D., Raphael, T. E., Benson, V. L., & Madda, C. L. (2007). Balance in comprehensive literacy instruction: Then and now. In L. B. Gambrell, L. M. Morrow, & M. Pressley (Eds.), *Best practices in literacy instruction* (2nd ed., pp. 30–54). New York, NY: Guilford.
- Peer, J., & Fraser, B. J. (2015). Gender, grade-level and stream differences in learning environment and student attitudes in primary science classrooms in Singapore. *Learning Environments Research*, 18(1), 143–161.
- Pekrun, R. (2006). The control–value theory of achievement emotions: Assumptions, corollaries, and implications for educational research and practice. *Educational Psychology Review*, 18(4), 315–341.

- Pekrun, R., Goetz, T., Frenzel, A. C., Barchfeld, P., & Perry, R. P. (2011). Measuring emotions in students' learning and performance: The Achievement Emotions Questionnaire (AEQ). *Contemporary Educational Psychology, 36*(1), 36–48.
- Pekrun, R., Goetz, T., Titz, W., & Perry, R. P. (2002). Positive emotions in education. In E. Frydenberg (Ed.), *Beyond coping: Meeting goals, visions, and challenges* (pp. 149–173). Oxford University Press.
- Pekrun, R., & Stephens, E. J. (2011). Academic emotions. In K. R. Harries, S. Graham, & T. Urda (Eds.), *APA educational psychology handbook* (Vol. 2, pp. 3–31). Washington, DC: American Psychological Association.
- Pelgrum, W. J. (2001). Obstacles to the integration of ICT in education: Results from a worldwide educational assessment. *Computers & Education, 37*(2), 163–178.
- Persson, L., & Svensson, M. (2017) Classmate characteristics, class composition and children's perceived classroom climate. *Journal of Public Health, 25*(5), 473–480.
- Petegem, K., Aelterman, A., Rosseel, Y., & Creemers, B. (2007). Student perception as moderator for student wellbeing. *Social Indicators Research, 83*(3), 447–463.
- Phan, H. P. (2011). Interrelations between self-efficacy and learning approaches: A developmental approach. *Educational Psychology, 31*(2), 225–224.
- Phan, H. P., & Ngu, B. H. (2014). Interrelations between self-esteem and personal self-efficacy in educational contexts: An empirical study. *International Journal of Applied Psychology, 4*(3), 108–120.
- Phillips, D. C., & Burbules, N. C. (2000). *Postpositivism and educational research*. Lanham, MD: Rowman & Littlefield.

- Pickett, L. H., & Fraser, B. J. (2009). Evaluation of a mentoring program for beginning teachers in terms of the learning environment and student outcomes in participants' school classrooms. In A. Selkirk & M. Tichenor (Eds.), *Teacher education: Policy, practice and research* (pp. 1–15). New York, NY: Nova Science.
- Pilli, O., & Aksu, M. (2013). The effects of computer-assisted instruction on the achievement, attitudes and retention of fourth grade mathematics students in North Cyprus. *Computers & Education, 62*(3), 62–71.
- Pintrich, P. R., Smith, D. A. F., Garcia, T., & McKeachie, W. J. (1991). Reliability and predictive validity of the Motivated Strategies for Learning Questionnaire (MSLQ). *Educational and Psychological Measurement, 53*(3), 801–813.
- Poulou, M. S. (2017). An examination of the relationship among teachers' perceptions of social-emotional learning, teaching efficacy, teacher-student interactions, and students' behavioral difficulties. *International Journal of School & Educational Psychology, 5*(2), 126–136.
- Prestridge, S. (2007). Engaging with the transforming possibilities of ICT: A discussion paper. *Australian Educational Computing, 22*(2), 3–9.
- Rahman, H. (Ed.). (2008). *Developing successful ICT strategies: Competitive advantages in a global knowledge-driven society*. Hershey, PA: IGI Global.
- Reeves, D. (2010). *Transforming professional development into student results*. Alexandria, VA: Association for Supervision and Curriculum Development.
- Reinke, W. M., & Herman, K. C. (2002). Creating school environments that deter antisocial behaviours in youth. *Psychology in the Schools, 39*(5), 549–559.
- Rekha, B. K., Fisher, D. L., & Shaw, T. (2011). An application of the TROFLEI in secondary-school science classes in New Zealand. *Research in Science & Technological Education, 29*(2), 147–167.

- Rennie, L. J. (2005). Equity in science teaching and learning: The inclusive science curriculum. In S. Alsop, L. Benze, & E. Pedretti (Eds.), *Analysing exemplary science teaching* (pp. 183–192). Columbus, OH: Open University Press.
- Rentoul, A., & Fraser, B. (1979). Conceptualisation of enquiry-based or open classroom learning environments. *Journal of Curriculum Studies*, 11(3), 233–245.
- Rita, R. D., & Martin-Dunlop, C. S. (2011). Perceptions of the learning environment and associations with cognitive achievement among gifted biology students. *Learning Environments Research*, 14(1), 25–38.
- Rodin, J. (1990). Control by any other name: Definitions, concepts, and processes. In J. Rodin, C. Schooler, & K. W. Schaie (Eds.), *Self-directedness: Cause and effects throughout the life course* (pp. 1–15). Hillsdale, NJ: Erlbaum.
- Romeo, G. I. (2006). Engage, empower, enable: Developing a shared vision for technology in education. In M. S. Khine (Ed.). *Engaged learning and emerging technologies*. Amsterdam, The Netherlands: Springer Science.
- Rowe, F., & Stewart, D. (2009). Promoting connectedness through whole-school approaches: A qualitative study. *Health Education*, 109(5), 396–413.
- Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, 55(1), 68–78.
- Sabale, J. R. (2015). A collective case study on two speech and language impaired learners with autism: The instructional implications of a hybrid applied behavior analysis (ABA) and iPad app-infused model. In H. An, S. Alon, & D. Fuentes (Eds.), *Tablets in K–12 education: Integrated experiences and implications* (pp. 198–237). Hershey, PA: IGI Global.

- Sabornie, E. J., & DeBettencourt, L. U. (2004). *Teaching students with mild and high incidence disabilities at the secondary level* (2nd ed.). Upper Saddle River, NJ: Pearson Merrill Prentice Hall.
- Sadker, D., & Silber, E. S. (2012). *Gender in the classroom: Foundations, skills, methods, and strategies across the curriculum*. Hoboken, NJ: Taylor & Francis.
- Saidin, N., & Brahim, M. M. F. M. (2012). No girls for me Mummy: Providing a positive language learning environment for boys in single gender classes. *Procedia—Social and Behavioral Sciences*, 38, 114–121.
- San Martin, T. L., & Calabrese, R. L. (2011). Empowering at-risk students through appreciative inquiry. *International Journal of Educational Management*, 25(2), 110–123.
- Sargeant, J., & Harcourt, D. (2012). *Doing ethical research with children*. Maidenhead, UK: Open University Press.
- Sasman, L. (2013). ICT creating another social divide. *Sister Namibia*, 25(2), 20–21.
- Saunders, K. J., & Fisher, D. L. (2006). An action research approach with primary pre-service teachers to improve university and primary school classroom environments. In D. L. Fisher & M. S. Khine (Eds.), *Contemporary approaches to research on learning environments* (pp. 247–272). Singapore: World Scientific.
- Sax, L. (2006). *Why gender matters: What parents and teachers need to know about the emerging science of sex differences*. New York, NY: Doubleday.
- Schenke, K., Ruzek, E., Lam, A. C., Karabenick, S. A., Eccles, J. S. (2017). Heterogeneity of student perceptions of the classroom climate: A latent profile approach. *Learning Environments Research*, 20(3), 289-306.

- Scherer, R., Rohatgi, A., & Hatlevik, O. E. (2017). Students' profiles of ICT use: Identification, determinants, and relations to achievement in a computer and information literacy test. *Computers in Human Behavior*, *70*, 486–499.
- Schiefele, U. (1991). Interest, learning, and motivation. *Educational Psychologist*, *26*(3–4), 299–323.
- Schneider, M., & Stern, E. (2010). The cognitive perspective on learning: Ten cornerstone findings. In H. Dumont, D. Istance, & F. Benavides (Eds.), *The nature of learning: Using research to inspire practice* (pp. 19–32). Paris, France: OECD.
- School Curriculum and Standards Authority. (2014) *Principles of teaching, learning and assessment*. Retrieved from <https://k10outline.scsa.wa.edu.au/home/principles/guiding-principles/teaching-learning-and-assessment-principles>
- Schroeder, N. J., & Adesope, O. O. (2015). Impacts of pedagogical agent gender in an accessible learning environment. *Educational Technology & Society*, *18*(4), 401–411.
- Schunk, D. H. (1989). Self-efficacy and achievement behaviors. *Educational Psychology Review*, *1*(3), 173–208.
- Schunk, D. H. (1992). Theory and research on student perceptions in the classroom. In D. H. Schunk & J. L. Meece (Eds.), *Student perceptions in the classroom* (pp. 3–23). Hillsdale, NJ: Lawrence Erlbaum.
- Schunk, D. H., & Zimmerman, B. J. (2013). Self-regulation and learning. In I. B. Weiner, W. M. Reynolds, & G. E. Miller (Eds.), *Handbook of psychology: Vol. 7. Educational psychology* (2nd ed, pp. 45–68). Hoboken, NJ: Wiley.
- Scott, R. H., & Fisher, D. L. (2004). Development, validation and application of a Malay translation of an elementary version of the Questionnaire on Teacher Interaction. *Research in Science Education*, *34*(2), 173–194.

- Scott Houston, L., Fraser, B. J., & Ledbetter, C. E. (2008). An evaluation of elementary school science kits in terms of learning environment and student attitudes. *Journal of Elementary Science Education, 20*(4), 29–47.
- Secada, W. G. (1995). Social and critical dimensions for equity in mathematics education. In W. G. Secada, E. Fennema, & L. B. Adajian (Eds.), *New directions for equity in mathematics education* (pp. 146–164). New York, NY: Cambridge University.
- Seligman, M., & Csikszentmihalyi, M. (2000). Positive psychology: An introduction. *American Psychologist, 55*(1), 5–14.
- Seo, Y., & Bryant, D. P. (2009). Analysis of studies of the effects of computer-assisted instruction on the mathematics performance of students with learning disabilities. *Computers & Education, 53*(3), 913–928.
- She, H. C., & Fisher, D. (2000). The development of a questionnaire to describe science teacher communication behavior in Taiwan and Australia. *Science Education, 84*(6), 706–726.
- Sherhoff, D. J., Csikszentmihalyi, M., Schneider, B., & Sherhoff, E. S. (2003). Student engagement in high school classrooms from the perspective of flow theory. *School Psychology Quarterly, 18*(2), 158–176.
- Shonkoff, J. P., & Phillips, D. A. (2000). Introduction. In J. P. Shonkoff & D. A. Phillips (Eds.), *From neurons to neighbourhoods: The science of early childhood development* (pp. 19–38). Washington, DC: National Academy Press.
- Siddiq, F., Scherer, R., & Tondeur, J. (2016). Teachers' emphasis on developing students' digital information and communication skills (TEDDICS): A new construct in 21st century education. *Computers & Education, 92–93*, 1–14.
- Sinclair, B., & Fraser, B. J. (2002). Changing classroom environments in urban middle schools. *Learning Environments Research, 5*(3), 301–328.

- Sink, C. A., & Spencer, L. R. (2005). My Class Inventory—Short Form as an accountability tool for elementary school counsellors to measure classroom climate. *Professional School Counselling, 9*(1), 37–48.
- Skaalvik, E., & Valas, H. (1999). Relations among achievement, self-concept, and motivation in mathematics and language arts: A longitudinal study. *Journal of Experimental Education, 67*(2), 135–149.
- Skinner, E. A. (1996). A guide to constructs of control. *Journal of Personality and Social Psychology, 71*(3), 549–570.
- Slavin, R. E. (2010). Co-operative learning: What makes group-work work? In H. Dumont, D. Istance, & F. Benavides (Eds.), *The nature of learning: Using research to inspire practice* (pp. 161–178). Paris, France: OECD.
- Snell, M. E., & Brown, F. (2000). *Instruction of students with severe disabilities* (5th ed.). Upper Saddle River, NJ: Merrill.
- Snell, S. (2012). *Variations in gender and age perceptions of mobile technology enhanced learning in a New Zealand tertiary institution* (Doctoral thesis). Retrieved from <https://espace.curtin.edu.au/handle/20.500.11937/1021>
- Soebari, T. S., & Aldridge, J. M. (2015). Using student perceptions of the learning environment to evaluate the effectiveness of a teacher professional development programme. *Learning Environments Research, 18*(2), 163–178.
- Soebari, T. S., & Aldridge, J. M. (2016). Investigating the differential effectiveness of a teacher professional development programme for rural and urban classrooms in Indonesia. *Teacher Development, 20*(5), 701–722.
- Solberg, V. S., O'Brien, K., Villareal, P., Kennel, R., & Davis, B. (1993). Self-efficacy and Hispanic college students: Validation of the College Self-Efficacy Inventory. *Hispanic Journal of Behavioral Sciences, 15*(1), 80–85.

- Song, H., Kidd, T., & Owens, E. (2011). Examining technological disparities and instructional practices in English language arts classroom: Implications for school leadership and teacher training. In L. Tomei (Ed.), *Online courses and ICT in education: Emerging practices and applications* (pp. 258–274). Hershey, PA: IGI Global.
- Spady, W. (1994). *Outcome-based education: Critical issues and answers*. Arlington, VA: American Association of School Administrators.
- Spinath, B., & Spinath, F. M. (2010). Longitudinal analysis of the link between learning motivation and competence beliefs among elementary school children. *Learning and Instruction, 15*(2), 87–102.
- Spinath, B., Spinath, F. M., Harlaar, N., & Plomin, R. (2006). Predicting school achievement from general cognitive ability, self-perceived ability, and intrinsic value. *Intelligence, 34*(4), 363–374.
- Spinath, F. M., Spinath, B., & Plomin, R. (2008). The nature and nurture of intelligence and motivation in the origins of sex differences in elementary school achievement. *European Journal of Personality, 22*(3), 211–229.
- Stahl, G. (2012). Boys and their schooling: The experience of becoming someone else. *Gender and Education, 24*(4), 465–467.
- Stern, G. G., Stein, M. I., & Bloom, B. S. (1956). *Methods in personality assessment*. Glencoe, IL: Free Press.
- Stevens, J. P. (1992). *Applied multivariate statistics for the social sciences* (2nd ed.). Hillsdale, NJ: Erlbaum.
- Stewart, E. A. (2003). School social bonds, school climate, and school misbehaviour: A multilevel analysis. *Justice Quarterly, 20*(3), 575–601.

- Stewart, W. P., & Floyd, M. F. (2004). Visualizing leisure. *Journal of Leisure Research, 36*(4), 445–460.
- Strati, A.D., Schmidt, J.A., & Maier, K.S. (2017). Perceived challenge, teacher support, and teacher obstruction as predictors of student engagement. *Journal of Educational Psychology, 109*(1), 131–147.
- Swanson, H. L. (1999). *Interventions for students with learning disabilities: Meta-analysis of treatment outcomes*. New York, NY: Guilford Press.
- Tamim, R. M., Bernard, R. M., Borokhovski, E., Abrami, P. C., & Schmid, R. F. (2011). What forty years of research says about the impact of technology on learning: A second-order meta-analysis and validation study. *Review of Educational Research, 81*(1), 4–28.
- Tan, I. G. C., Sharan, S., & Lee, C. K. E. (2007). Group investigation effects on achievement, motivation, and perceptions of students in Singapore. *Journal of Educational Research, 100*(3), 142–154.
- Taylor, P. C., Fraser, B. J., & Fisher, D. L. (1997). Monitoring constructivist classroom learning environments. *International Journal of Educational Research, 27*(4), 293–302.
- Taylor, R. L., Sternberg, L., & Richards, S. B. (1995). *Exceptional children: Integrating research and teaching*. San Diego, CA: Singular.
- Teglasi, H., Nebbergall, A. J., & Newman, D. (2012). Construct validity and case validity in assessment. *Psychological Assessment, 24*(2), 464–475.
- Teh, G. P. L., & Fraser, B. J. (1995). Associations between student outcomes and geography classroom environment. *International Research in Geographical and Environmental Education, 4*(1), 3–18.

- Telli, S., den Brok, P., & Cakiroglu, J. (2010). The importance of teacher–student interpersonal relationships for Turkish students’ attitudes towards science. *Research in Science and Technological Education*, 28(3), 261–276.
- Teo, T. (2012). A cross-cultural validation of the Selwyn’s Computer Attitude Scale (CAS). In L. Tomei (Ed.), *Advancing education with information communication technologies: Facilitating new trends* (pp. 139–149). Hershey, PA: IGI Global.
- Thalheimer, W., & Cook, S. (2002). *How to calculate effect sizes from published research articles: A simplified methodology*. Retrieved from http://www.bwgriffin.com/gsu/courses/edur9131/content/Effect_Sizes_pdf5.pdf
- Thompson, B. (2001). Significance, effect sizes, stepwise methods, and other issues: Strong arguments move the field. *Journal of Experimental Education*, 70(1), 80–93.
- Thompson, B. (2004). *Exploratory and confirmatory factor analysis: Understanding concepts and applications*. Washington, DC: American Psychological Association.
- Timperley, H. S. (2011). *Realizing the power of professional learning*. Maidenhead, UK: Open University Press.
- Tomte, C., & Hatlevik, O. E. (2011). Gender-differences in self-efficacy ICT related to various ICT-user profiles in Finland and Norway: How do self-efficacy, gender and ICT-user profiles relate to findings from PISA 2006. *Computers & Education*, 57(1), 1416–1424.
- Tran, B. (2016). The nature of research methodologies: Terms and usage within quantitative, qualitative, and mixed methods. In M. Baran & J. Jones (Eds.), *Mixed methods research for improved scientific study* (pp. 1–27). Hershey, PA: IGI Global.

- Trinidad, S., Aldridge, J., & Fraser, B. (2005). Development, validation and use of the online learning environment survey. *Australasian Journal of Educational Technology, 21*(1), 60–81.
- Trochim, W., & Donnelly, J. P. (2008). *The research methods knowledge base*. Mason, OH: Cengage Learning.
- Tshewang, R., Chandra, V., & Yeh, A. (2017). Students' and teachers' perceptions of classroom learning environment in Bhutanese eighth-grade mathematics classes. *Learning Environment Research, 20*(2), 269–288.
- Tuan, H., Chin, C., & Shieh, S. (2005). The development of a questionnaire to measure students' motivation towards science learning. *International Journal of Science Education, 27*(6), 639–654.
- Usher, E. L., & Pajares, F. (2006) Sources of academic and self-regulatory efficacy beliefs of entering middle school students. *Contemporary Educational Psychology, 31*(2), 125–141.
- Valentine, G. (1999). Being seen and heard? The ethical complexities of working with children and young people at home and at school. *Ethics, Place & Environment, 2*(2), 141–155.
- Valtonen, T., Kukkonen, J., Kontkanen, S., Sormunen, K., Dillon, P., & Sointu, E. (2015). The impact of authentic learning experiences with ICT on pre-service teachers' intentions to use ICT for teaching and learning. *Computers & Education, 81*, 49–58.
- Vandecandelaere, M., Speybroeck, S., Vanlaar, G., De Fraine, B., & Van Damme, J. (2012). Learning environment and students' mathematics attitude. *Studies in Educational Evaluation, 38*(3–4), 107–120.

- Velayutham, S., & Aldridge, J. M. (2013). Influence of psychosocial classroom environment on students' motivation and self-regulation in science learning: A structural equation modeling approach. *Research in Science Education, 43*(2), 507–527.
- Velayutham, S., Aldridge, J. M., & Fraser, B. J. (2011). Development and validation of an instrument to measure students' motivation and self-regulation. *International Journal of Science Education, 33*(15), 1–21.
- Venkatesh, V., Morris, M., Davis, G., & Davis, F. (2003). User acceptance of information technology: Toward a unified view. *Management Information Systems Quarterly, 27*(3), 425–478.
- Vygotsky, L. S. (1972). *Thought and language*. Massachusetts Institute of Technology Press.
- Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological process*. Cambridge, MS: Harvard University Press.
- Wahyudi, W., & Treagust, D. F. (2004). The status of science classroom learning environments in Indonesian lower secondary schools. *Learning Environments Research, 7*(1), 43–63.
- Walberg, H. J. (Ed.). (1979). *Educational environments and effects: Evaluation, research and policy*. Berkeley, CA: McCutchan.
- Walberg, H. J., & Anderson, G. J. (1968). Classroom climate and individual learning. *Journal of Educational Psychology, 59*(6), 414–419.
- Walberg, H. J., & Haertel, G. D. (1980). Validity and use of educational environment assessments. *Studies in Educational Evaluation, 6*(3), 225–238.
- Waldrip, B. G., & Wong, A. F. L. (1996). Association of attitudes with science laboratory environments in Singapore and Papua New Guinea. *Journal of Science and Mathematics in South East Asia, 14*, 26–37.

- Walker, S. L. (2006). Development and validation of the Test of Geography-Related Attitudes (ToGRA). *Journal of Geography*, 105(4), 175–181.
- Walker, S. L., & Fraser, B. J. (2005). Development and validation of an instrument for assessing distance education learning environments in higher education: The Distance Education Learning Environments Survey (DELES) for higher education. *Learning Environments Research*, 8(3), 267–287.
- Wang, M. T. (2009). School climate support for behavioral and psychological adjustment: Testing the mediating effect of social competence. *School Psychology Quarterly*, 24(4), 240–225.
- Wang, M. T., & Eccles, J. S. (2012). Social support matters: Longitudinal effects of social support on three dimensions of school engagement from middle to high school. *Child Development*, 83(3), 877–895.
- Warner, R. (1980). Enjoyment. *The Philosophical Review*, 89(4), 507–526.
- Wehrwein, E. A., Lujan, H. L., & DiCarlo, S. E. (2007). Gender differences in learning style preferences among undergraduate physiology students. *Advances in Physiology Education*, 31(2), 153–157.
- Weiner, B. (1985). An attributional theory of achievement motivation and emotion. *Psychological Review*, 92(4), 548–573.
- Welsh, W. (2000). The effects of school climate on school disorder. *Annals of the American Academy of Political and Social Science*, 567(1), 88–107.
- Wentzel, K. R. (1998). Social support and adjustments in middle school: The role of parents, teachers, and peers. *Journal of Educational Psychology*, 90(2), 202–209.
- Wentzel, K. R., Battle, A., & Looney, L. (2010). Social supports from teachers and peers as predictors of academic and social motivation. *Contemporary Educational Psychology*, 35(3), 193–202.

- Wentzel, K. R., & Wigfield, A. (1998). Academic and social motivational influences on students' academic performance. *Educational Psychology Review*, *10*(2), 155–175.
- Westwood, P. (2004). *Learning and learning difficulties: A handbook for teachers*. Camberwell, Australia: Australian Council for Educational Research Press.
- White, R. W. (1959). Motivation reconsidered: The concept of competence. *Psychological Review*, *66*(5), 297–333.
- Wigfield, A., & Eccles, J. S. (2000). Expectancy–value theory of achievement motivation. *Contemporary Educational Psychology*, *25*(1), 68–81.
- Wigfield, A., Eccles, J. S., & Rodriguez, D. (1998). The development of children's motivation in school contexts. *Review of Research in Education*, *23*(1), 73–118.
- Wigfield, A., Eccles, J. S., Yoon, K. S., Harold, R. D., Arbreton, A. J. A., Freedman-Doan, C., & Blumenfeld, P. (1997). Change in children's competence beliefs and subjective task values across the elementary school years: A 3-year study. *Journal of Educational Psychology*, *89*(3), 451–469.
- Wigfield, A., & Guthrie, J. T. (1997). Relations of children's motivation for reading to the amount and breadth of their reading. *Journal of Educational Psychology*, *89*(3), 420–432.
- Wiggins, G., & McTighe, J. (2005). *Understanding by design* (2nd ed.). Alexandria, VA: Association for Supervision and Curriculum Development.
- William, D. (2005). Keeping learning on track: Formative assessment and the regulation of learning. In M. Coupland, J. Anderson, & T. Spencer (Eds.), *Making mathematics vital: Proceedings of the twentieth biennial conference of the Australian Association of Mathematics Teachers* (pp. 20–34). Adelaide, Australia: Australian Association of Mathematics Teachers.

- Wilkin, C. L., Rubino, C., Zell, D., & Shelton, L. M. (2013). Where technologies collide: A technology integration model. *Cutting-Edge Technologies in Higher Education*, 6, 81–106.
- Wilks, S. (1935). On the independence of k sets of normally distributed statistical variables. *Econometrica*, 3(3), 309–326.
- Wolf, S. J., & Fraser, B. J. (2008). Learning environment, attitudes and achievement among middle-school science students using inquiry-based laboratory activities. *Research in Science Education*, 38(3), 321–341.
- Wong, A. F. L., & Fraser, B. J. (1995). Cross-validation in Singapore of the Science Laboratory Environment Inventory. *Psychological Reports*, 76, 907–911.
- Wong, A. F. L., & Fraser, B. J. (1996). Environment-attitude associations in the chemistry laboratory classroom. *Research in Science and Technological Education*, 14(1), 91–102.
- Wong, A. L. F., Quek, C. L., Divaharan, S., Liu, W. C., Peer, J., & Williams, M. D. (2006). Singapore students' and teachers' perceptions of computer supported project work classroom learning environments. *Journal of Research in Technology Education*, 38(4), 449–479.
- Woodward, J., & Carnine, D. (1993). Uses of technology for mathematics assessment and instruction: Reflection on a decade of innovations. *Journal of Special Education Technology*, 12(1), 38–48.
- Wright, D. E. (2015). *Active Learning: Social Justice Education and Participatory Action Research*. Florence, KY: Taylor & Francis.
- Wu, D., Bieber, M., & Hiltz, S. R. (2009). Asynchronous participatory exams: Internet innovation for engaging students. *Institute of Electrical and Electronics Engineers Internet Computing*, 13(2), 44–50.

- Wubbels, T. (1993). *Teacher–student relationships in science and mathematics classes*. Perth, Australia: Curtin University of Technology.
- Wubbels, T., Brekelmans, M., & Hooymayers, H. (1991). Interpersonal teacher behavior in the classroom. In B. J. Fraser & H. J. Walberg (Eds.), *Educational environments: Evaluation, antecedents and consequences* (pp. 141–160). London, UK: Pergamon.
- Wubbels, T., Creton, H. A., & Hooymayers, H. P. (1985). *Discipline problems of beginning teachers*. Paper presented at the annual meeting of the American Educational Research Association, Chicago, IL. Retrieved from <https://eric.ed.gov/?id=ED260040>
- Wubbels, T., & Levy, J. (1991). A comparison of interpersonal behavior of Dutch and American teachers. *International Journal of Intercultural Relations*, 15(1), 1–18.
- Wubbels, T., & Levy, J. (Eds.). (1993). *Do you know what you look like?: Interpersonal relationships in education*. London, UK: Falmer Press.
- Yarrow, A. (1997). Improving university and primary school classroom environments through preservice teachers' action research. *International Journal of Practical Experiences in Professional Education*, 1(1), 68–93.
- Zaman, M., Anandarajan, M., & Dai, Q. (2010). Experiencing flow with instant messaging and its facilitating role on creative behaviors. *Computers in Human Behavior*, 26(5), 1009–1018.
- Zandvliet, D. B., & Fraser, B. J. (2005). Physical and psychosocial environments associated with networked classrooms. *Learning Environment Research*, 8(1), 1–17.
- Zhang, L., & Zhang, X. (2003). A study of the relationships among learning strategy use, self-efficacy, persistence and academic achievement in middle school students. *Psychological Science*, 4, 603–607.

Zimmerman, B. J. (1995). Attaining reciprocity between learning and development through self-regulation. *Human Development*, 38(6), 367–372.

Zimmerman, B. J. (2000). Self-efficacy: An essential motive to learn. *Contemporary Educational Psychology*, 25(1), 82–91.

Zimmerman, B. J., & Bandura, A. (1994). Impact of self-regulatory influences on writing course attainment. *American Educational Research Journal*, 31(4), 845–862.

Every reasonable effort has been made to acknowledge the owners of copyright material. I would be pleased to hear from any copyright owner who has been omitted or incorrectly acknowledged

APPENDIX 1

PERMISSION TO REPRODUCE INFORMATION IN TABLE 2.1

From: Barry Fraser [mailto:B.Fraser@curtin.edu.au]
Sent: Sunday, 3 December 2017 10:41 AM
To: Siobhan Galos (St Bernard's School) <Siobhan.Galos@cewa.edu.au>
Subject: RE: Permission to use an adaption of a table from your work

Siobhan

He way that you have acknowledges the source of the table looks ok to me.

Dr Barry J Fraser

FIAE FTSE FASSA FAAAAS FAERA FACE

John Curtin Distinguished Professor

Science and Mathematics Education Centre

School of Education

Tel | +61 8 9266 7896

Fax | +61 8 9266 2503

Email | B.Fraser@curtin.edu.au

Web | <http://smec.curtin.edu.au>

Address | GPO Box U1987 Perth WA 6845



Curtin University is a trademark of Curtin University of Technology.
CRICOS Provider Code 00301J (WA), 02637B (NSW)

From: Siobhan Galos (St Bernard's School) [<mailto:Siobhan.Galos@cewa.edu.au>]
Sent: Friday, 1 December 2017 10:34 AM
To: Barry Fraser
Subject: Permission to use an adaption of a table from your work

Dear Professor Fraser

Attached is a copy of a table that, with your permission, I would like to include in my doctoral thesis.

This is adapted from a table published in your work (Fraser, 1998).

Would you be willing to grant me permission to include the attached table in my thesis?

Kind regards
Siobhan Galos

Dear Siobhan,

I would be happy for you to use this adaptation of the table from our work.

Best wishes

Jill

Dr Jill Aldridge

**Associate Professor | Science and Mathematics Education Centre
School of Education**

Curtin University

Tel | +61 8 9266 3592

Fax | +61 8 9266 2503

Email | J.Aldridge@curtin.edu.au

Web | <http://curtin.edu.au>

Curtin University is a trademark of Curtin University of Technology.
CRICOS Provider Code 00301J

From: Siobhan Galos (St Bernard's School) [<mailto:Siobhan.Galos@cewa.edu.au>]

Sent: Thursday, 30 November 2017 4:39 PM

To: Jill Aldridge <J.Aldridge@curtin.edu.au>

Subject: Permission to use an adaption of a table from your work

Dear Associate Professor Aldridge

Attached is a copy of a table that, with your permission, I would like to include in my doctoral thesis.

This is adapted from a table published in your work (Bell and Aldridge, 2014).

Would you be willing to grant me permission to include the attached table in my thesis?

Kind regards

Siobhan Galos

From: BELL Lisa [Perth Modern School] [<mailto:Lisa.Bell1@education.wa.edu.au>]
Sent: Monday, 4 December 2017 11:46 AM
To: Siobhan Galos (St Bernard's School) <Siobhan.Galos@cewa.edu.au>
Subject: RE: Contact email for Lisa Bell

Hi Siobhan,
Yes of course – and good luck to you with your writing (definitely a challenging task)

All the best,
Lisa Bell

From: Siobhan Galos (St Bernard's School) [<mailto:Siobhan.Galos@cewa.edu.au>]
Sent: Monday, 4 December 2017 11:41 AM
To: BELL Lisa [Perth Modern School] <Lisa.Bell1@education.wa.edu.au>
Subject: RE: Contact email for Lisa Bell

Hi Lisa
Yes thank you so much for getting back to me. I'm a current Ph.D. student at Curtin University being supervised by Jill Aldridge.
Attached is a copy of a table that, with your permission, I would like to include in my thesis. This is adapted from a table published in your work (Bell and Aldridge, 2014).
Would you be willing to grant me permission to include the attached table in my thesis?

Kind regards
Siobhan Galos

APPENDIX 2

PERMISSION TO REPRODUCE FIGURE 2.1

Dear Siobhan,

You are free to reproduce these from the website, providing that you acknowledge ACARA (refer to <http://www.australiancurriculum.edu.au/copyrightatpoint4>).

They are covered under the general creative commons licence.

Kind regards,

From: Galos, Siobhan [<mailto:galos.siobhan@cathednet.wa.edu.au>]

Sent: Thursday, 13 October 2016 7:15 PM

To: ACARA Copyright <ACARA.Copyright@acara.edu.au>

Subject: Permission for use of Organising elements for ICT Capability diagram in Ph.D. Thesis

Importance: High

To Whom It May Concern

Please find attached a letter requesting permission to use the *Organising elements for ICT Capability* diagram from the Australian Curriculum in my Ph.D. thesis.

Kind regards

Siobhan Galos

APPENDIX 3

CLASSROOM CLIMATE QUESTIONNAIRE—PRIMARY (CCQ-P)

| |
|---|
| <p>Classroom Climate Questionnaire</p> <p>Primary</p> |
|---|

| Background Information | | | | |
|------------------------|--------------------------|---|-----|------|
| i. | Are you a boy or a girl? | | Boy | Girl |
| ii. | What year are you in? | 4 | 5 | 6 |

| Learning Environment Scales | | | | | | | | | | | |
|---|--|---------------------|---------------|-------------------|--------------|----------------------|---------------------|---------------|-------------------|--------------|----------------------|
| Student Cohesiveness (Friendships) - assesses the extent to which there is an environment in which students feel accepted and supported by their classmates and safe to express their ideas. | | ACTUAL | | | | | PREFERRED | | | | |
| | | <i>Almost Never</i> | <i>Rarely</i> | <i>Some-times</i> | <i>Often</i> | <i>Almost Always</i> | <i>Almost Never</i> | <i>Rarely</i> | <i>Some-times</i> | <i>Often</i> | <i>Almost Always</i> |
| 1. | I get on well with students in this class. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 2. | Students in this class are my friends. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 3. | I get to know the students in this class. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 4. | I am friendly to students in this class. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 5. | Students in this class like me. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| Teacher Support - assesses the extent to which the teacher helps, befriends, trusts and is interested in students. | | ACTUAL | | | | | PREFERRED | | | | |
| | | <i>Almost Never</i> | <i>Rarely</i> | <i>Some-times</i> | <i>Often</i> | <i>Almost Always</i> | <i>Almost Never</i> | <i>Rarely</i> | <i>Some-times</i> | <i>Often</i> | <i>Almost Always</i> |
| 6. | The teacher helps me with my work. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 7. | The teacher cares about my feelings. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 8. | The teacher listens to me. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 9. | The teacher is interested in how I am going. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 10. | The teacher helps me to understand my work. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |

Learning Environment Scales

| Equity (Fairness) – assesses the extent to which students are treated fairly by the teacher. | | ACTUAL | | | | | PREFERRED | | | | |
|--|---|---------------------|---------------|------------------|--------------|----------------------|---------------------|---------------|------------------|--------------|----------------------|
| | | <i>Almost Never</i> | <i>Rarely</i> | <i>Sometimes</i> | <i>Often</i> | <i>Almost Always</i> | <i>Almost Never</i> | <i>Rarely</i> | <i>Sometimes</i> | <i>Often</i> | <i>Almost Always</i> |
| 11. | I get as much say as other students. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 12. | I get the same encouragement from the teachers as other students do. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 13. | I get the same opportunity to ask questions as other students. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 14. | I get the same opportunity to take part in discussions as other students. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 15. | I get the same opportunity to answer questions as other students. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| Task Clarity (Knowing what to do) – assesses the extent to which students are provided with clear information about what they need to do and how they can do it well. | | ACTUAL | | | | | PREFERRED | | | | |
| | | <i>Almost Never</i> | <i>Rarely</i> | <i>Sometimes</i> | <i>Often</i> | <i>Almost Always</i> | <i>Almost Never</i> | <i>Rarely</i> | <i>Sometimes</i> | <i>Often</i> | <i>Almost Always</i> |
| 16. | I know what I need to do to complete my school work. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 17. | The instructions for tasks are clear. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 18. | I know how to complete tasks successfully. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 19. | I understand how to do a good job in my tasks. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 20. | I understand the instructions that are given. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |

| Learning Environment Scales | | | | | | | | | | | |
|--|--|-------------------------|---------------|------------------------|--------------|--------------------------|-------------------------|---------------|------------------------|--------------|--------------------------|
| Responsibility for Learning (Taking responsibility) – assesses the extent to which students feel that they are given responsibility for their own learning. | | ACTUAL | | | | | PREFERRED | | | | |
| | | <i>Almost Never</i> | <i>Rarely</i> | <i>Some- times</i> | <i>Often</i> | <i>Almost Always</i> | <i>Almost Never</i> | <i>Rarely</i> | <i>Some- times</i> | <i>Often</i> | <i>Almost Always</i> |
| 21. | I am expected to work independently. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 22. | I am given responsibility | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 23. | I am expected to think for myself | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 24. | I am given the opportunity to be independent | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 25. | I am encouraged to work independently. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| Involvement (Being involved) – assesses the extent to which students are interested and participate in discussions. | | ACTUAL | | | | | PREFERRED | | | | |
| | | <i>Almost Never</i> | <i>Rarely</i> | <i>Some- times</i> | <i>Often</i> | <i>Almost Always</i> | <i>Almost Never</i> | <i>Rarely</i> | <i>Some- times</i> | <i>Often</i> | <i>Almost Always</i> |
| 26. | I discuss ideas in class | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 27. | I give my opinions during class discussions | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 28. | The teacher asks me questions | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 29. | My ideas are used during classroom discussions | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 30. | I explain my ideas to other students | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |

| Learning Environment Scales | | | | | | | | | | | |
|---|---|---------------------|---------------|------------------|--------------|----------------------|---------------------|---------------|------------------|--------------|----------------------|
| Task Orientation (Getting my work done) – assesses the extent to which it is important to complete activities planned. | | ACTUAL | | | | | PREFERRED | | | | |
| | | <i>Almost Never</i> | <i>Rarely</i> | <i>Sometimes</i> | <i>Often</i> | <i>Almost Always</i> | <i>Almost Never</i> | <i>Rarely</i> | <i>Sometimes</i> | <i>Often</i> | <i>Almost Always</i> |
| 31. | Getting my work done is important to me | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 32. | I work hard even if I do not like what I am doing. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 33. | I pay attention during class. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 34. | I try to understand the work. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 35. | I know how much work I have to do. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| Personal Relevance (Usefulness of what I learn) – assesses the extent to which the subject is relevant to students' everyday out-of-school experiences. | | ACTUAL | | | | | PREFERRED | | | | |
| | | <i>Almost Never</i> | <i>Rarely</i> | <i>Sometimes</i> | <i>Often</i> | <i>Almost Always</i> | <i>Almost Never</i> | <i>Rarely</i> | <i>Sometimes</i> | <i>Often</i> | <i>Almost Always</i> |
| 36. | I use what I learn in my everyday life. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 37. | I can make connections between what I learn in this class to my life outside of school. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 38. | What I learn in this class is useful. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 39. | What I learn is important to my life outside of school. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 40. | I use what I learn in my life outside of school. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |

| Learning Environment Scales | | | | | | | | | | | |
|---|--|---------------------|---------------|------------------|--------------|----------------------|---------------------|---------------|------------------|--------------|----------------------|
| Collaboration (Working together) – assesses the extent to which students collaborate with one another on learning tasks | | ACTUAL | | | | | PREFERRED | | | | |
| | | <i>Almost Never</i> | <i>Rarely</i> | <i>Sometimes</i> | <i>Often</i> | <i>Almost Always</i> | <i>Almost Never</i> | <i>Rarely</i> | <i>Sometimes</i> | <i>Often</i> | <i>Almost Always</i> |
| 41. | We work in groups (or pairs) in this class. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 42. | In this class, there is teamwork. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 43. | I work with other students. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 44. | I share with other students when doing class work. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 45. | Working with other students helps me to learn. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |

APPENDIX 4

ICT USAGE SURVEY

| |
|------------------|
| ICT Usage Survey |
|------------------|

| Background Information | | | |
|------------------------|--------------------------|---|---------------|
| i. | Are you a boy or a girl? | | Boy Girl |
| ii. | What year are you in? | 4 | 5 6 |

| ICT Scales | | | | | | | | | | | |
|---|--|-------------------------|---------------|------------------------|--------------|--------------------------|-------------------------|---------------|------------------------|--------------|--------------------------|
| Investigating with ICT (Finding things out with ICT) | | ACTUAL | | | | | PREFERRED | | | | |
| | | <i>Almost Never</i> | <i>Rarely</i> | <i>Some- times</i> | <i>Often</i> | <i>Almost Always</i> | <i>Almost Never</i> | <i>Rarely</i> | <i>Some- times</i> | <i>Often</i> | <i>Almost Always</i> |
| 1. | My teacher helps me to plan online searches. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 2. | My teacher helps me to search for information on the internet. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 3. | My teacher helps me to search within documents, programs and applications. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 4. | My teacher helps me to look for information to solve a problem using ICT. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 5. | My teacher helps me to search for up-to-date information using ICT. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 6. | My teacher helps me to evaluate the information I find. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |

| ICT Scales | | | | | | | | | | | |
|---|--|---------------------|---------------|-------------------|--------------|----------------------|---------------------|---------------|-------------------|--------------|----------------------|
| Creating with ICT (Being creative with ICT) | | ACTUAL | | | | | PREFERRED | | | | |
| | | <i>Almost Never</i> | <i>Rarely</i> | <i>Some-times</i> | <i>Often</i> | <i>Almost Always</i> | <i>Almost Never</i> | <i>Rarely</i> | <i>Some-times</i> | <i>Often</i> | <i>Almost Always</i> |
| 7. | My teacher helps me to record my ideas (e.g. using a mind map). | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 8. | My teacher helps me to create ideas (e.g. using brainstorming). | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 9. | My teacher helps me to record my ideas using video. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 10. | My teacher helps me to use a range of ICT to create solutions to problems. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 11. | My teacher helps me to record my ideas using a sound recorder. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 12. | My teacher helps me to create solutions to problems. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 13. | My teacher helps me to be creative using ICT in different ways. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |

| ICT Scales | | | | | | | | | | | |
|--|--|-------------------------|---------------|------------------------|--------------|--------------------------|-------------------------|---------------|------------------------|--------------|--------------------------|
| Communicating with ICT (Using ICT to communicate) | | ACTUAL | | | | | PREFERRED | | | | |
| | | <i>Almost Never</i> | <i>Rarely</i> | <i>Some- times</i> | <i>Often</i> | <i>Almost Always</i> | <i>Almost Never</i> | <i>Rarely</i> | <i>Some- times</i> | <i>Often</i> | <i>Almost Always</i> |
| 14. | I communicate with my teacher electronically (e.g. email). | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 15. | I share information online (e.g. discussion board or blog). | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 16. | I submit my homework or assignments using ICT. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 17. | I use electronic communication to work with other students. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 18. | I communicate with classmates using ICT. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 19. | I share my learning with my class using ICT. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 20. | I share my work with other students online (e.g. wikis or blogs). | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 21. | I share my ideas with other students online (e.g. wikis or blogs). | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |

| ICT Scales | | | | | | | | | | | |
|---|--|---------------------|---------------|------------------|--------------|----------------------|-----------|--|--|--|--|
| Applying Social and Ethical Protocols and Practices (Doing the right thing) | | ACTUAL | | | | | PREFERRED | | | | |
| | | <i>Almost Never</i> | <i>Rarely</i> | <i>Sometimes</i> | <i>Often</i> | <i>Almost Always</i> | | | | | |
| 22. | In this class, I am reminded to acknowledge or give credit to the source if I use someone else's work. | 1 | 2 | 3 | 4 | 5 | | | | | |
| 23. | In this class, I am reminded to never share my private information online. | 1 | 2 | 3 | 4 | 5 | | | | | |
| 24. | In this class, I am reminded to never share my password(s). | 1 | 2 | 3 | 4 | 5 | | | | | |
| 25. | In this class, I am reminded of the need to be careful when sharing information in online communities. | 1 | 2 | 3 | 4 | 5 | | | | | |
| 26. | In this class, I am helped to understand the positive and negatives of using ICT. | 1 | 2 | 3 | 4 | 5 | | | | | |

| ICT Scales | | | | | | | | | | |
|--|--|---------------------|---------------|-------------------|--------------|----------------------|-----------|--|--|--|
| Changing Trends | | ACTUAL | | | | | PREFERRED | | | |
| | | <i>Almost Never</i> | <i>Rarely</i> | <i>Some-times</i> | <i>Often</i> | <i>Almost Always</i> | | | | |
| 27. | In this class, ICT has changed the types of tasks we do. | 1 | 2 | 3 | 4 | 5 | | | | |
| 28. | In this class, we do tasks that would not have been possible without computers. | 1 | 2 | 3 | 4 | 5 | | | | |
| 29. | In this class, we use ICT to do the same types of work as we used to do without computers. | 1 | 2 | 3 | 4 | 5 | | | | |
| 30. | In this class, we use ICT to do the same types of work we used to do without digital technology; however, we do these tasks easier, quicker or better. | 1 | 2 | 3 | 4 | 5 | | | | |
| <i>Managing and Operating ICT Effectively (Using ICT)</i> | | ACTUAL | | | | | PREFERRED | | | |
| | | <i>Almost Never</i> | <i>Rarely</i> | <i>Some-times</i> | <i>Often</i> | <i>Almost Always</i> | | | | |
| 31. | In this class, I use word processing (e.g. Word or Pages) to do work. | 1 | 2 | 3 | 4 | 5 | | | | |
| 32. | In this class, I use word processing to insert photographs/graphics/tables. | 1 | 2 | 3 | 4 | 5 | | | | |
| 33. | In this class, I use ICT to make notes on documents. | 1 | 2 | 3 | 4 | 5 | | | | |
| 34. | In this class, I edit digital photos or other images and insert them into documents. | 1 | 2 | 3 | 4 | 5 | | | | |
| 35. | In this class, I use a spreadsheet (e.g. Excel or Numbers). | 1 | 2 | 3 | 4 | 5 | | | | |
| 36. | In this class, I use a spreadsheet to create graphs. | 1 | 2 | 3 | 4 | 5 | | | | |

APPENDIX 5

SELF-EFFICACY AND ENJOYMENT QUESTIONNAIRE (SEEQ) SCALES AND ITEMS

| |
|--|
| <p>Self-Efficacy and Enjoyment Questionnaire</p> <p>(SEEQ)</p> |
|--|

| Background Information | | | | |
|------------------------|--------------------------|---|-----|------|
| i. | Are you a boy or a girl? | | Boy | Girl |
| ii. | What year are you in? | 4 | 5 | 6 |

| SEEQ Scales | | | | | | | | | |
|--|---|-------------------------|---------------|------------------------|--------------|--------------------------|-----------|--|--|
| Self-Efficacy (Self-belief) | | ACTUAL | | | | | PREFERRED | | |
| | | <i>Almost Never</i> | <i>Rarely</i> | <i>Some- times</i> | <i>Often</i> | <i>Almost Always</i> | | | |
| 1. | I am good at my work | 1 | 2 | 3 | 4 | 5 | | | |
| 2. | My friends ask me for help in this class. | 1 | 2 | 3 | 4 | 5 | | | |
| 3. | I find the work in this class easy. | 1 | 2 | 3 | 4 | 5 | | | |
| 4. | I can understand what the teacher tells me. | 1 | 2 | 3 | 4 | 5 | | | |
| 5. | I help my friends with their class work. | 1 | 2 | 3 | 4 | 5 | | | |
| Enjoyment of Class (Enjoyment of this class) | | ACTUAL | | | | | PREFERRED | | |
| | | <i>Almost Never</i> | <i>Rarely</i> | <i>Some- times</i> | <i>Often</i> | <i>Almost Always</i> | | | |
| 6. | I enjoy the lessons that we do in this class. | 1 | 2 | 3 | 4 | 5 | | | |
| 7. | Lessons in this class are fun. | 1 | 2 | 3 | 4 | 5 | | | |
| 8. | I look forward to coming to class. | 1 | 2 | 3 | 4 | 5 | | | |
| 9. | I have a good time in this class. | 1 | 2 | 3 | 4 | 5 | | | |
| 10. | This class makes me want to come to school. | 1 | 2 | 3 | 4 | 5 | | | |

| SEEQ Scales | | | | | | | | | | |
|------------------|--|-------------------------|---------------|------------------------|--------------|--------------------------|-----------|--|--|--|
| Enjoyment of ICT | | ACTUAL | | | | | PREFERRED | | | |
| | | <i>Almost Never</i> | <i>Rarely</i> | <i>Some- times</i> | <i>Often</i> | <i>Almost Always</i> | | | | |
| 11. | I enjoy lessons that use ICT. | 1 | 2 | 3 | 4 | 5 | | | | |
| 12. | Lessons that use ICT are fun. | 1 | 2 | 3 | 4 | 5 | | | | |
| 13. | I look forward to lessons that use ICT. | 1 | 2 | 3 | 4 | 5 | | | | |
| 14. | Using ICT makes me want to come to school. | 1 | 2 | 3 | 4 | 5 | | | | |
| 15. | Using ICT helps me to learn. | 1 | 2 | 3 | 4 | 5 | | | | |

APPENDIX 6

PERMISSION TO REPRODUCE FIGURE 3.1

To: Siobhan Galos

Thanks for your interest in using my Research Methods Knowledge Base materials.

In case your institution requires it, this e-mail is my permission for you to use the web site as described in your message.

Best of luck with your work.

William M. Trochim, Ph.D.

607-255-0887

607-255-1150 fax

<https://proxy.qualtrics.com/proxy/?url=http%3A%2F%2Fwww.socialresearchmethods.net%2F&token=Lng3gz1UeTk0uOQXBoMoiE5%2BYJuH0UrBRLUHUJVCls%3D>

Professor, Policy Analysis & Management, Cornell University

Director, Cornell Office for Research on Evaluation (CORE)

<https://proxy.qualtrics.com/proxy/?url=http%3A%2F%2Fcore.human.cornell.edu%2F&token=t1z4ZaFKfpQIM16fZiMy0IXZDYSKU4ATWWTYs4Silic%3D>

Director of Evaluation for Extension & Outreach, Cornell University

<https://proxy.qualtrics.com/proxy/?url=http%3A%2F%2Fcore.human.cornell.edu%2Foutreach%2F&oken=Rgk4zzBtUp69df1ONu%2BNIDCDkskLUJ8Y5CJ9NKDb0Mw%3D>

Mailing Address:

120 Martha Van Rensselaer Hall

Cornell University

Ithaca, NY 14853

Professor, Department of Public Health, Weill Cornell Medical College

Director of Evaluation, Clinical & Translational Science Center

<https://proxy.qualtrics.com/proxy/?url=http%3A%2F%2Fwww.med.cornell.edu%2Fctsc%2F&token=4KA3EC5x3aTx5WpDwa6y0mjiImgzvfuHV8MvAE11Rgo%3D>

NYC Address:

CTSC

407 East 61st St.

Second Floor

NY, NY 10021

Recipient Data:

Time Finished: 2017-09-02 04:16:29 EDT

IP: 180.95.40.14

ResponseID: R_BK5YwTk7SDUAITH

Link to View Results: [Click Here](#)

URL to View Results:

https://proxy.qualtrics.com/proxy/?url=https%3A%2F%2Fcornell.qualtrics.com%2FCP%2FReport.php%3FSID%3DSV_e9T9VQ15cEXzOAY%26R%3DR_BK5YwTk7SDUAITH&token=6gEMRRVU%2BI4%2FufIgLob8tNOFIEILwff4PcFKkfnDDo%3D

Dear Dr Trochim

I am currently a Ph.D. student at Curtin University in Western Australia and am writing to request your permission to include and reference a copy of your Construct Validity diagram in my thesis (from Trochim, W. M., & Donnelly, J. P. (2008). The research methods knowledge base (3rd ed.). Cincinnati, OH: Atomic Dog.)

Kind regards

Siobhan Galos

APPENDIX 7

CURTIN UNIVERSITY ETHICS APPROVAL



| Memorandum | |
|------------|--|
| To | Professor Graham Dellar, Education |
| From | Professor Peter O'Leary, Chair Human Research Ethics Committee |
| Subject | Protocol Approval HR 72/2014 |
| Date | 15 April 2014 |
| Copy | Mrs Siobhan Galos Education |

Office of Research and Development
Human Research Ethics Committee

TELEPHONE 9266 2784
FACSIMILE 9266 3793
EMAIL hrec@curtin.edu.au

Thank you for providing the additional information for the project titled "*Evaluating the effectiveness of increasing the integration and use of digital technology in primary school classrooms: Learning environment perceptions and motivation of at-risk students*". The information you have provided has satisfactorily addressed the queries raised by the Committee. Your application is now **approved**.

- You have ethics clearance to undertake the research as stated in your proposal.
- The approval number for your project is **HR 72/2014**. Please quote this number in any future correspondence.
- Approval of this project is for a period of four years **15-04-2014 to 16-04-2018**.
- Your approval has the following conditions:
 - i) Annual progress reports on the project must be submitted to the Ethics Office.
- **It is your responsibility, as the researcher, to meet the conditions outlined above and to retain the necessary records demonstrating that these have been completed.**

Applicants should note the following:

It is the policy of the HREC to conduct random audits on a percentage of approved projects. These audits may be conducted at any time after the project starts. In cases where the HREC considers that there may be a risk of adverse events, or where participants may be especially vulnerable, the HREC may request the chief investigator to provide an outcomes report, including information on follow-up of participants.

The attached **Progress Report** should be completed and returned to the Secretary, HREC, C/- Office of Research & Development annually.

Our website https://research.curtin.edu.au/guides/ethics/non_low_risk_hrec_forms.cfm contains all other relevant forms including:

- Completion Report (to be completed when a project has ceased)
- Amendment Request (to be completed at any time changes/amendments occur)
- Adverse Event Notification Form (If a serious or unexpected adverse event occurs)

Yours sincerely,

Professor Peter O'Leary
Chair Human Research Ethics Committee

APPENDIX 8

CATHOLIC EDUCATION OFFICE OF WESTERN AUSTRALIA APPROVAL



16 April 2014

Mrs Siobhan Galos
Team Leader
Teaching and Learning
Catholic Education Office of Western Australia
50 Ruislip Street
LEEDERVILLE WA 6007

Dear Siobhan

**RE: EVALUATING THE EFFECTIVENESS OF INCREASING THE INTEGRATION AND USE
OF DIGITAL TECHNOLOGY IN PRIMARY SCHOOL CLASSROOMS: LEARNING
ENVIRONMENT PERCEPTIONS AND MOTIVATION OF AT-RISK STUDENTS**

Thank you for your completed application received 18 December 2013, whereby this project will examine whether students, particularly those who are 'at risk', are more motivated to learn when teachers increase the integration and use of digital technology into the learning environment.

I give in principle support for the selected Catholic schools in Western Australia to participate in this valuable study. However, consistent with CEOWA policy, participation in your research project will be the decision of the individual principal and staff members.

Responsibility for quality control of ethics and methodology of the proposed research resides with the institution supervising the research. The CEOWA notes that Curtin University Human Research Ethics Committee has granted permission for this research project until 16 April 2018 (Approval Number: HR 72/2014).

Any changes to the proposed methodology will need to be submitted for CEOWA approval prior to implementation. The focus and outcomes of your research project are of interest to the CEOWA. It is therefore a condition of approval that the research findings of this study are forwarded to the CEOWA.

Further enquiries may be directed to Jane Gostelow at gostelow.jane@ceo.wa.edu.au or (08) 6380 5118.

I wish you all the best with your research.

Yours sincerely

Dr Tim McDonald



EXECUTIVE DIRECTOR OF CATHOLIC EDUCATION
50 Ruislip Street, Leederville WA 6007 | PO Box 198, Leederville WA 6003
T: (08) 6380 5210
E: mcdonald.tim@ceo.wa.edu.au | W: ceo.wa.edu.au

APPENDIX 9

TEACHER INFORMATION SHEET AND CONSENT FORM

Curtin University
School of Education



Information Sheet - Teachers

Evaluating the Effectiveness of Increasing the Integration and use of Digital Technology in Primary School Classrooms: Learning Environment Perceptions and Motivation of At-Risk Students

My name is Siobhan Galos. I am currently completing research for my PhD at Curtin University.

Purpose of Research

I am researching how the use of technology in classrooms affects student motivation.

Your Role

Your role firstly involves identifying any students in your class who you believe to be 'at risk' and confirming this against the students' NAPLAN results. That is, any child who scored below the benchmark in their Year 3 and/or 5 Literacy and/or Numeracy NAPLAN results. Your role then involves your students completing 2 online surveys. Each should take no longer than 30 minutes to complete. The surveys will measure student perceptions of their learning environment. The results will provide you with information about your classroom environment. From this data you will be able to select a focus area. You will then be able to work towards improving this aspect of the learning environment. The surveys will be repeated at the end of term. This will measure whether the changes you made improved student motivation. You will also be asked to document your journey in a journal. A focus group of teachers will be selected to participate in short classroom observations and interviews approximately three times during the term. The aim of this is to identify how you feel about the process and what changes you made. The time commitment involves two one hour training sessions on how to implement the surveys and analyse the data, 2 hours in total to administer pre and post testing during class time and 20 minutes per week of journaling. If required to participate in classroom observations, these would take place approximately 3 times per term for a duration of approximately 2 hours and the subsequent interview would take no longer than one hour.

Consent to Participate

Your involvement in the research is voluntary. You have the right to choose not to participate. You may ask to withdraw at any time. If you agree to take part, please sign the attached form.

Confidentiality

Student surveys will not have any names or personal details on them. Instead, codes will be used to ensure that all data is confidential. Data collected will only be used for the specific purpose of this research project. The purpose of this study is not to evaluate you. Responses will not be shared with your principal. Names will not be used in any publication or presentation of the research. All data will be kept in a locked draw. Electronic data will be kept under password-protection. After 5 years all data will be destroyed. Only my supervisor and I will have access to the data.

Further Information

This study has been approved by the Curtin University Human Research Ethics Committee (Approval Number HR72/2014). The Committee is comprised of members of the public, academics, lawyers, doctors and pastoral carers. If needed, verification of approval can be obtained either by writing to the Curtin University Human Research Ethics Committee, c/- Office of Research and Development, Curtin University, GPO Box U1987, Perth, 6845 or by telephoning 9266 2784 or by emailing hrec@curtin.edu.au. This research has also been approved by the Catholic Education Office of W.A. If you would like further information about the study, please contact me on 0457 568 894 or by email galos.siobhan@cathodnet.wa.edu.au.

Thank you for your involvement in this research.

Your participation is greatly appreciated.

Consent Form -Teachers

Evaluating the Effectiveness of Increasing the Integration and use of Digital Technology in Primary School Classrooms: Learning Environment Perceptions and Motivation of At-Risk Students

I have been informed of the purposes of this study.

I understand the purposes of this study.

I have been given an opportunity to ask questions about the study.

I understand participation in this study involves administering pre and post surveys with my class.

I understand that I will be asked to keep a journal and I may be asked to participate in observations and interviews.

I understand that I can withdraw from this study at any time.

I understand that that any information that might identify me will not be shown to my Principal or used in published material.

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

Name: _____

Signature: _____

Date: _____

APPENDIX 10

PARENT INFORMATION SHEET AND CONSENT FORM

Curtin University
School of Education



Information Sheet - Parents

Evaluating the Effectiveness of Increasing the Integration and use of Digital Technology in Primary School Classrooms: Learning Environment Perceptions and Motivation of At-Risk Students

My name is Siobhan Galos. I am currently completing research for my Doctorate of Philosophy degree at Curtin University.

Purpose of Research

I am researching how the use of technology in classrooms affects student motivation.

Your Role

Your role is to give permission for your child to take part in this study. The process involves your child answering 2 online surveys during class time. Each should take no longer than 30 minutes. The teacher will help children to read the questions. The surveys will measure what students think about their learning environment. From this data the teacher will be able to select an area of focus and work towards improving the learning environment. The surveys will be repeated at the end of the term. This will measure whether the changes made by the teacher improved student motivation. Students will be asked for verbal permission to take part. Your child can ask to stop at any time.

Consent to Participate

The involvement of your child in the research is voluntary. You or your child may choose not to participate or to ask to withdraw from the study at any time. If you agree to your child's participation, please sign the consent form attached. Please return the form to your child's teacher.

Confidentiality

Student surveys will not have any names or personal details on them. The class teacher will not be able to identify individual responses. Data collected will only be used for the specific purpose of this research project. The purpose of this study is not to evaluate your child or their teacher. Names will not be used in any publication of the research. All data will be kept in a locked draw. Electronic data will be kept under password-protection. After 5 years all data will be destroyed. Only my supervisor and I will have access to the data.

Further Information

This study has been approved by the Curtin University Human Research Ethics Committee (Approval Number HR72/2014). The Committee is comprised of members of the public, academics, lawyers, doctors and pastoral carers. If needed, verification of approval can be obtained either by writing to the Curtin University Human Research Ethics Committee, c/- Office of Research and Development, Curtin University, GPO Box U1987, Perth, 6845 or by telephoning 9266 2784 or by emailing hrec@curtin.edu.au. This research has also been approved by the Catholic Education Office of W.A. If you would like further information about the study, please contact me on 0457 568 894 or by email galos.siobhan@cathodnet.wa.edu.au.

**Thank you for your involvement in this research.
Your participation is greatly appreciated..**

Consent Form -Parents

Evaluating the Effectiveness of Increasing the Integration and use of Digital Technology in Primary School Classrooms: Learning Environment Perceptions and Motivation of At-Risk Students

I have been informed of the purposes of this study.

I understand the purposes of this study.

I have been given an opportunity to ask questions about the study.

I understand that participation of my child involves 2 online surveys. These surveys will be repeated at the end of term.

I understand that I can withdraw my child from this study at any time.

Any information that might identify the school or my child will not be used in published material.

I agree to the participation of my child in the study as outlined to me.

Student Name: _____

Parent Name: _____

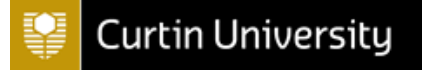
Signature: _____

Date: _____

APPENDIX 11

STUDENT INFORMATION SHEET

Curtin University
School of Education



Student Information Sheet

How does technology help my learning?

My name is Siobhan Galos. I would like your help with some research I am doing about how children learn.

Purpose of the Research

I am interested in how using technology might improve how much you enjoy learning.

Your Task

Your task is to complete 2 short online quizzes. Each quiz will take about 30 minutes. Your teacher will ask the class to do this during school time. Your teacher will read the questions to you and give you help if you need it. Each quiz will ask you questions about your classroom. Your teacher will not be able to see your answers. Your answers will be completely private. Your teacher will get a class summary so that they can try to make your classroom better.

You will be asked to complete each quiz again at the end of term. The good thing about taking part is that you are able to give ideas to your teacher about how to make your classroom better.

Permission

Taking part in the quizzes is your choice. You do not have to take part if you don't want to. If you change your mind you can ask to stop at any time. Your parents will need to sign a form for you to take part. If you do not wish to take part please let your teacher know.

Privacy

All of your answers will be private and will only be used for this research. You do not have to write your name on any quiz. You will be given a number instead so that your teacher won't be able to tell what your answers were. This study is not to judge you or your teacher. It is about looking at whether using technology helps your learning.

Thank you for your help with this important study.