Science and Mathematics Education Centre

Learning Environments in English Classrooms in Singapore: Determinants and Effects

Donna Lim Ching-Tse

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DECLARATION

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university. To the best of my knowledge and belief, this thesis contains no material previously published by any person except where due acknowledgement has been made.

Signature: 

Date: November 2013

ABSTRACT

This study involved validating a modified learning environment questionnaire, investigating sex and ethnic differences, and exploring associations between students' attitudes and the learning environment of primary English Language classrooms. The research was carried out in four similar government-run co-educational primary schools in Singapore. The sample consisted of 441 students in 22 classes, with 202 male students compared with 232 female students and with 279 Chinese students compared with 89 Malay students.

The questionnaire consisted of slightly-modified scales from the What Is Happening In this Class? (WIHIC), the Test of Science Related Attitudes (TOSRA) and the Morgan-Jinks Student Efficacy Scale (MJSES). The WIHIC was used to assess student perceptions of Singaporean primary English Language classrooms, whereas the TOSRA and the MJSES were used to assess student attitudes and efficacy related to the English Language subject, respectively. Data analysis supported the WIHIC's factorial validity, internal consistency reliability, and ability to differentiate between classrooms when used with primary school children in Singapore. Similarly, the factorial validity and reliability of the modified TOSRA and the MJSES were supported.

MANOVA revealed statistically-significant sex differences in Task Orientation and Cooperation. Effect sizes of 0.35 and 0.37 standard deviations were reported for these two scales, placing them in the small to modest range. Interestingly, sex differences were consistently in the same direction for all eight scales, with female students reporting somewhat more positive perceptions of their learning environment, attitudes and academic efficacy.

MANOVA also revealed statistically-significant ethnic differences in Teacher Support and Involvement. Effect sizes of 0.32 and 0.53 standard deviations were reported for these two scales, placing them in the modest to medium magnitude range. Differences in scale scores between Chinese and Malay students were consistently in the same direction for all eight scales, with

Malay students reporting more positive perceptions of their learning environment, attitudes and academic efficacy.

Simple correlation analysis revealed that all learning environment scales were significantly and positively correlated with both attitudes to English and academic efficacy. The multiple correlation for the set of WIHIC scales was statistically significant for attitudes and for efficacy. An examination of multivariate associations revealed that Teacher Support, Task Orientation and Equity were positively, significantly and independently associated with attitude to English, whereas Involvement and Equity were significant independent predictors of efficacy.

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God has a strange way of doing things. Increasingly, I cannot help but to trust in His hand and His heart to accomplish goals that are beyond me. Yet, His grace amazes me with the precious people He sends along to make the journey that much better, that much sweeter. If all the world's a stage and we are all actors, then this is a roll call of my *Academy Awards* list:

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Chapter 1

INTRODUCTION AND OVERVIEW

1.1 Context of the Study

Having been in the teaching field for slightly over a decade now, it seems to me that the classroom climate has very much been underplayed in traditional local approaches to teaching and learning. It is not hard to see why as it is often hidden and easily neglected. Fraser (2007, p. 3) acknowledges this elusiveness, calling the learning environment a "subtle concept". He pointed out that students would have spent nearly 20,000 hours in educational institutions by the time when they have completed their university education. That is indeed a significant amount of time and, to a large extent, would impact on student learning as evidenced by some of the research undertaken in this area. I am thus convinced of the merits of studying the learning environment of the English Language classroom with the aim of improving teaching and learning practices.

For example, with the implementation of new initiatives from the Ministry of Education (MOE), classrooms have seen a greater influx of cooperative learning strategies. However, hardly any large-scale research has been undertaken that incorporates learning environment measures. In addition, although student academic achievement has been closely tracked by schools, rarely do schools draw on information about students' perceptions of their learning environment to enhance their learning. Much emphasis has been placed on academic outcomes rather than other aspects of learning. This led to the then Minister of Education of Singapore to reiterate the words of the Prime Minister in a Ministry of Education Work Plan Seminar in 2005:

> *Teach Less, Learn More (TLLM) is not a call for a 'teacher to do less'. It is a call for educators to teach better, to engage our students and prepare them for life, rather than to teach for tests and examinations. This is why TLLM really goes to the core of quality in education. It is*

about a richer interaction between teacher and student – about touching hearts and engaging minds.

In recent years, the MOE in Singapore has instituted new directions for teaching and learning. Syllabus revisions were undertaken including the English Language Syllabus 2001 and recently, building from the previous version, the English Language Syllabus 2010. A framework for teaching and learning also came into the picture in the form of PETALS^{TM} (Use of Pedagogies, Experiences of Learning, Tone of Environment, Assessment for Learning, and Learning Content) with the intention of influencing primary school education (Primary 1 – Primary 6). It became apparent that other aspects of education were receiving more attention. With the introduction of the SEED (Strategies for Effective Engagement and Development of pupils) approach in the lower primary (Primary 1 to Primary 2), there has been an increased emphasis on student-centred teaching and learning strategies. The STELLAR (Strategies for English Language Learning and Reading) approach that soon followed for primary schools saw this slant towards the EL classroom specifically. (Refer to Appendix A for a list of websites describing these policies/initiatives.)

The general aim seems to be higher engagement of students in the classroom. The pertinent question that follows is whether these approaches can be shown by research to be effective. Therefore it makes sense to investigate students' views of the classroom so as to enable teachers to more effectively modify and cater for the needs of their students.

As mentioned above, I have been a teacher for almost a decade and therefore have been privy to these changes. This change in the educational scene with regard to English teaching became a strong motivation for me to investigate the 'new' learning environment of primary English classrooms and, in particular, to seek out the 'voices' of the children regarding their English classrooms. To maintain an objective view, I chose students who were not under my purview and included schools other than my own for administering the learning environment instrument.

I am interested in what goes on in the English classroom. Teaching and learning practices in English Language classrooms intrigue me and much research has been conducted to improve the English classroom. However, I feel that attention to the learning environment on the local scene is much underplayed. It is acknowledged as an important factor for students' learning, but it has not been validly measured and used to guide improvements in teaching and learning practices in the English Language.

In the larger context of Singapore, it is apparent that there is a heavy emphasis on assessing student achievement or measuring learning outcomes. While this is worthwhile, it does not give educators, as aptly put by Fraser (2007, p. 103), "a complete picture of the educational process". Given the amount of time that a student spends in his/her learning environment, it is desirable to study the learning environment and to change it in order to render teaching and learning more effective.

Although there have been considerable advancements in learning environment research, I feel that there is scope for more research especially on the local scene in Singapore. Much has been accomplished in the subject areas of mathematics and science, but little literature or documentation has surfaced that involves the English Language classroom.

Hence, one of the aims of my research was to modify versions of the What Is Happening In this Class? (WIHIC) questionnaire, the Test of Science Related Attitudes (TOSRA) and the Morgan-Jinks Student Efficacy Scale (MJSES) for use in the local English classroom. In addition to this, I hope that this research could perhaps provide educators with better insights into local primary English Language classrooms so that they can better adjust their instructional delivery.

1.2 Theoretical Framework

Much of the work in the field of learning environments in the past 40 years can be traced back to Lewin’s (1936) seminal work on field theory in which

he recognised that both the environment and its interaction with personal characteristics of the individual play an important part in determining human behaviour. This resulted in the now familiar Lewinian formula, $B = f(P, E)$, which stresses the need for research to consider that behaviour is a function of the person and the environment. Following this train of thought, Murray (1938) developed a needs–press model which allows the analogous representation of person and environment in common terms. From this came fundamental terms such as 'alpha press' and 'beta press' to distinguish between observing the learning environment as an inhabitant (alpha press) or as a detached observer (beta press). This theory was later popularised and elucidated by Stern (1970). This is relevant to my research which focused on the determinants of classroom environment (specifically, sex and ethnicity).

The pioneering work of Moos (1974) and Walberg and Anderson (1968) deserves mention here as it led to the development of significant instruments in the field of learning environment in the 1960s. Moos' work, which largely involved social climate scales used in a variety of human environments such as hospitals and correctional institutions, led to the development of the Classroom Environment Scale (CES) (Moos & Trickett, 1974). Three categories were proposed by Moos (1974) for classifying the diverse characteristics of any human environment:

i. Relationship Dimensions (which assess the nature and intensity of personal relationships within the environment and the extent to which people are involved in the environment and support and help each other)
ii. Personal Development Dimensions (which assess basic directions along which personal growth and self-enhancement tend to occur)
iii. System Maintenance and System Change Dimensions (which assess the extent to which the environment is orderly, clear in expectations, maintains control and is responsive to change).

As noted later in Chapter 2, Moos' three fundamental types of dimensions can be used to classify the individual scales in contemporary classroom environment questionnaires.

Walberg's significant contribution was the development of the Learning Environment inventory (LEI). This was a consequence of his work on Harvard Project Physics in the 1960s which initiated using classroom environment assessments in the evaluation of curriculum innovations (Walberg & Anderson, 1968). This study supported the view that students could make valid summary judgements about their classrooms. The LEI was validated in the USA with 1083 students from 149 classes (Walberg & Anderson, 1968).

Building on the work of their predecessors, Wubbels and his colleagues embarked on research involving interactions between teachers and students in the classroom in The Netherlands. This gave birth to yet another historically-significant and currently-used learning environment instrument – the Questionnaire on Teacher Interaction (QTI) (Wubbels & Brekelmans, 2012; Wubbels, Brekelmans, den Brok & van Tartwijk, 2006; Wubbels & Levy, 1993). Subsequently, research on teacher–student interpersonal behaviour permeated many other countries as well, including research by Scott and Fisher (2004) in Brunei Darussalam, Quek, Wong and Fraser (2005) in Singapore, Lee, Fraser and Fisher (2003) in Korea and Fraser, Aldridge and Soerjaningsih (2010) in Indonesia.

Around the same time, programmatic research began in Australia. This focused on student-centred classrooms and involved the use of the Individualised Classroom Environment Questionnaire (ICEQ) (Fraser, 1990; Fraser & Butts, 1982). The significant difference between the ICEQ and the LEI and CES is that the latter two involve teacher-centred classrooms while the ICEQ focuses on student-centred ones. This allows the ICEQ to assess those dimensions that are essential to open or individualised classroom settings. Progressing from here, Fraser was also involved in Australia in developing and customising numerous other purpose-specific learning environment instruments, and cross-validating them and applying them for

various research purposes around the world (Fraser, 2012). These widely-used questionnaires include the Science Learning Environment Questionnaire (SLEQ), Constructivist Learning Environment Survey (CLES) and What Is Happening In this Class? (WIHIC), which are reviewed in detail in Chapter 2 of this thesis.

Learning environment research, with its foundation stones in the USA and its pioneering programmes initiated in The Netherlands and Australia, soon spread to many parts of the world. In particular, research in Asia in this field also grew rapidly and with it came internationally significant contributions: in Singapore, by Teh and Fraser (1994, 1995), Wong and Fraser (1996), Goh and Fraser (1996), Quek, Wong and Fraser (2005), Khoo and Fraser (2008), Chionh and Fraser (2009) and Peer and Fraser (in press); in Indonesia, by Wahyudi and Treagust (2004), Fraser, Aldridge and Adolphe (2010) and Fraser, Aldridge and Soerjaningsih (2010); in Korea, by Kim, Fisher and Fraser (2000) and Fraser and Lee (2009); and in Taiwan, by Aldridge, Fraser and Huang (1999) and Aldridge and Fraser (2000).

1.3 Learning Environment and Attitude Instruments Unique to My Study

This study involved the use of three main instruments:

i. What Is Happening In this Class? (WIHIC) questionnaire
ii. Test of Science-related Attitudes (TOSRA)
iii. Morgan-Jinks Student Efficacy Scale (MJSES).

The next few paragraphs give an overview of these instruments. Further elaboration of each specific instrument is found in Chapter 2.

The WIHIC questionnaire combines salient scales from a wide range of modified existing questionnaires with additional scales to encompass contemporary educational aspects such as equity and constructivism (Fraser, 2012). Refinements to this instrument led to the final form containing seven

eight-item scales – Student Cohesiveness, Teacher Support, Involvement, Investigation, Task Orientation, Cooperation and Equity. It has a five-point frequency response scale ranging from Almost Never to Very Often. The WIHIC gained popularity over the years for use as a classroom environment instrument around the world. This achievement is noted by Dorman (2008) who gave it "almost bandwagon status in the assessment of classroom environments" (p. 181).

A number of studies have made use of the WIHIC in various countries (including Asia) and in various languages, including: in Taiwan and Australia with 1879 grade 7–9 students from 50 classes (Aldridge, Fraser & Huang, 1999); in Indonesia with 1400 lower-secondary science students in 16 classes (Wahyudi & Treagust, 2004); in Korea with 543 grade 8 science students in 12 schools (Kim, Fisher & Fraser, 2000); and in Singapore with 2310 grade 10 geography and mathematics students (Chionh & Fraser, 2009). Chapter 2 reviews these and other studies involving the WIHIC in more detail.

The TOSRA was developed by Fraser (1978, 1981) to measure students' attitudes towards their science classes. This instrument was based on Klopfer's (1976) taxonomy of the affective domain with regards to science education. There are seven scales in total – Social Implications of Science, Normality of Scientists, Attitude to Scientific Inquiry, Adoption of Scientific Attitudes, Enjoyment of Science Lessons, Leisure Interest in Science, and Career Interest in Science. Each scale consists of 10 items with a five-point Likert response scale ranging from Agree to Strongly Disagree.

The validity and successful use of the TOSRA have been borne out by several studies. For example, Wong and Fraser (1996) modified the TOSRA and used it with a sample of 1592 final year (or tenth grade) secondary school chemistry students in 56 classes from 28 randomly-selected coeducational government schools in Singapore. Statistical analyses of the data supported the validity and reliability of this modified instrument. This modified questionnaire was again used in another study with a sample of 497

tenth grade students from three independent schools in Singapore and was again found to be valid and reliable (Quek, Wong & Fraser, 2005). Fraser, Aldridge and Adolphe (2010) reported a cross-national study of learning environments and attitudes to science with 594 students from Indonesia and 567 from Australia. This use of the TOSRA scales attested to the internal consistency reliability and empirical independence of the TOSRA scales for both the Indonesian and Australian versions. The TOSRA is further considered in Section 2.5.3 of Chapter 2.

Although the MJSES has not been as widely used as the WIHIC and the TOSRA, I decided to incorporate one of its scales into this study as it assesses the self-efficacy construct. Past research supports the notion that a student's perception of self-efficacy can influence learning behaviour, with high self-efficacy positively affecting engagement, effort, persistence, goal setting and performance (Bandura, 1982, 1989; Schunk 1989; Zimmerman, Bandura, & Martinez-Pons, 1992). Pajares (1996) reported that increased self-efficacy often is associated with increased willingness to engage and persist in challenging tasks. Reviews of research also corroborate the notion that higher self-efficacy leads to an increase in the quality and quantity of information processed and that high-efficacy students are likely to use a wider spread of strategies more flexibly and to process information at a deeper level (Pajares, 1996; Schunk, 1989). More specifically, research findings reported by Aldridge and Fraser (2008) support associations between the learning environment and academic efficacy, lend strength to the notion that the learning environment created by teachers can influence the cognitive and affective outcomes of their students. Section 2.5.3 in Chapter 2 further considers the MJSES.

1.4 Research Aims

My general research question involved some of the determinants and effects of the learning environment in primary English Language (EL) classrooms in Singapore. This research aimed to:

i. modify and validate questionnaires for assessing the learning environment and student attitudes specifically in primary English Language classrooms in Singapore

ii. investigate differences in students' perceptions of the learning environment and attitudes in primary English Language classrooms between:
   a. male and female students
   b. Chinese and Malay students

iii. investigate associations between students' attitudes and the learning environment of primary English Language classrooms.

1.5 Significance

This study is significant for three main reasons. First, it offers a window into the Singapore primary English classroom. Although a great amount of learning environment research has been undertaken in science and mathematics classes, little past research offers insights into the area of English. This study, therefore, offers educators (especially, educators in ethnically-diverse second-language learner classrooms) a glimpse into primary student perceptions of the English classroom and, to a certain extent, guides them in bringing about improvements in the teaching of English in primary classrooms.

Secondly, while much past research on learning environment has focused on older students, this research involved primary children (around 12 years of age). In Singapore, not much voice is given to children in deciding the direction of their English lessons and the choice of materials and resources to be used in the classroom. However, this study offers a platform for the voices of children to be heard. Although it might not bring about major changes, perhaps small steps in the classroom could be taken to improve the teaching and learning of English.

Thirdly, Lewin (1936) convincingly argues that both the environment and its interaction with personal characteristics of the individual play an important

part in determining human behaviour. It is worthwhile, therefore, to undertake a study to investigate if there are differences in perceptions of the learning environment between males and females and, because Singapore prides itself in being a multiracial society, this was extended to differences in perceptions among the dominant races (Chinese and Malay).

1.6 Overview of Thesis Chapters

This thesis consists of five chapters in total. Chapter 1 introduced the study by presenting background information in order to provide a context for understanding the study. This encompassed background information, a theoretical framework, aims and objectives, and the significance of the study.

Chapter 2 provides a review of current literature relevant to this study. It traces the history of the field of learning environments, acknowledging pioneering work as well as progress and developments in this area. The chapter devotes space to the three instruments used in my study – the What Is Happening In this Class? (WIHIC) questionnaire, Test of Science-Related Attitudes (TOSRA) and Morgan–Jinks Student Efficacy Scale (MJSES). The chapter also deals with past research that involved sex and ethnic differences in perceptions of the learning environment, as well as associations between the learning environment and student attitudes. These constructs were central to this study.

Chapter 3 provides a description of the methods used in this study. It begins by making explicit the specific research questions so as to show alignment of the research methods with the objectives of the research. Included is a description of the sample of participants, the adoption, modification and assembling of the final research instrument, and the administration procedures for the survey. It concludes with a discussion of the data-collection procedures and the methods of statistical analysis used to answer my study's research questions.

Chapter 4 reports the analyses and results in answer to each specific research question. The first set of research findings (which address the first research question) involved the validation of the WIHIC, TOSRA (enjoyment scale) and MJSES (self-efficacy) scales. Factor analysis, discriminant validity and internal consistency reliability analyses are reported. The second research involved sex and ethnic differences in students' perceptions of the learning environment and attitudes in English Language primary classrooms. Here, MANOVA was employed and both statistical significance and effect sizes are reported for both sex and ethnic differences. To address the third research question, associations between the learning environment and students' attitudes are reported based on simple correlation and multiple regression analyses (using two units of analysis).

Finally, Chapter 5 concludes the thesis with a summary of results related to the research aims and objectives. It also reviews and justifies the reasons for conducting this study. Limitations and implications are also discussed, together with recommendations and suggestions for future research.

Chapter 2

LITERATURE REVIEW

2.1 Introduction

As elaborated in Chapter 1, this study aimed to validate a modified learning environment and attitude questionnaire suitable for primary classrooms in Singapore, investigate sex and ethnic differences in perceptions of the learning environment and attitudes, and investigate associations between students' attitudes and the nature of the classroom learning environment.

It is thus apt to review literature pertaining to these areas in this chapter using the following organisation:

2.2 Historical Perspectives on Learning Environment Research
2.3 Range of Learning Environment Instruments
2.4 Types of Learning Environment Research
2.5 Attitudes and Efficacy
2.6 Chapter Summary.

2.2 Historical Perspectives on Learning Environment Research

Learning environment research has its origin in ideas mooted by Lewin (1936) and Murray (1938) in the 1930s. Lewin (1936) put forth the theory that, in addition to personal characteristics, the environment codetermines human behaviour. This is reflected in his longstanding formula, $B = f(P, E)$, in which human behaviour (B) is seen as a function of the interaction between the individual person (P) and the environment (E).

Murray (1938) extended this theory to a need–press model to describe an individual's personal needs and environmental press. He was responsible for introducing the terms 'alpha press' and 'beta press' to distinguish between observing an environment as an inhabitant (alpha press) or as a detached

observer (beta press). Stern, Stein and Bloom (1956) further developed this idea by dividing the concept of the beta press into 'private' beta press (which refers to the individual student's view of his or her learning environment) and 'consensual' beta press (which refers to the view held by the entire class as an entity).

Fraser (2012) aptly pointed out the advantages of making judgements about the classroom through the eyes of students or, in the light of Murray's (1938) work, *inhabitants*. Students would have more time in classrooms to form more accurate depictions of the class as compared to an observer. Moreover, they would also have the added advantage of context when forming their opinions or judgements about the class. An additional merit is that, although there always would be a tendency for teachers to be inconsistent from lesson to lesson, these inconsistencies over a longer duration of time would make up a more consistent picture of the "long-standing attributes of the classroom environment" (Fraser, 2012, p. 4). Students, by virtue of the fact that they remain for a longer time in the classroom, are in a good position to provide a more consistent picture of the classroom.

These ideas were later expounded by Moos (1974) and Walberg (1981). Much of the work stemmed from the notion that interaction between the environment and individual traits can strongly influence the individual's behaviour. As mentioned in Chapter 1, Moos' (1974) three fundamental types of dimensions – Relationship, Personal Development and System Maintenance and System Change Dimensions – come into play here.

The first two classroom instruments that were developed were the Learning Environment Inventory (LEI) and the Classroom Environment Scale (CES). Both the LEI (Walberg & Anderson, 1968) and the CES (Moos & Trickett, 1974) emerged in the USA. The use of the LEI in a large-scale study using the Hindi language (Walberg, Singh & Rasher, 1977) revealed that the learning environment accounted for significant amounts of variance in students' achievement beyond general ability. Use of the CES and LEI revealed that factors that enhanced individual modernity seemed to be

greater task orientation, competition and difficulty and less order and organisation in classrooms, while factors enhancing achievement were higher speed and lower order and organisation in classes (Paige, 1979). A simplified form of the LEI was later developed and termed the My Class Inventory (Fisher & Fraser, 1981). These three instruments (further detailed in Sections 2.3.1, 2.3.2 and 2.3.5) were designed for teacher-centred classrooms and this was reflective of the education scene then.

Research in this area has come a long way. A literature review seems to indicate that learning environment research has largely centred on and established itself in science education. According to Fraser (2007), it has been widely conducted in many countries and with numerous students and there have been consistent findings of a strong influence of the learning environment on student outcomes.

In addition, research in this area has also shed light on subtle nuances in the classroom. Particularly in Asia, the determinant of the classroom environment that has been the focus of most research is student sex. Research findings reveal that females tend to have more favourable views of their classroom climate than do males (Chionh & Fraser, 2009; Kim, Fisher & Fraser, 2000; Margianti, Fraser, & Aldridge 2001a, 2001b).

Fraser (2002, p.17) reported the "strong emphasis on the use of a variety of validated and robust questionnaires that assess students' perceptions of their classroom environments" in the first two decades in Western countries. Many of these questionnaires assess perceptions of either the teacher and students in terms of teacher support, participation, task orientation, innovation, cooperation and personal relevance (Fraser, 2012). However, the quality of such constructs very much depends on the intent of the research. Fraser (1998, p. 624) highlights the importance of using "multiple theoretical perspectives" to gain an enhanced picture of the learning environment in question. There is a need to carefully deliberate on the theoretical framework (and with it the underlying beliefs and assumptions) so as to draw out the most meaning in the studied context.

Fraser (2012) also lists various applications of learning environment instruments in past research – curriculum evaluation, transition to different levels of education, improvement of classroom learning environment, and incorporating learning environment ideas in school psychology. With such widespread impact, the value of researching learning environment thus cannot be underestimated. Numerous possibilities spring up for the use of learning environment tools to improve teaching and learning in the classroom.

2.3 Range of Learning Environment Questionnaires

The field of learning environment research has seen the development of key instruments that are reviewed below, touching first on historically-significant questionnaires – Learning Environment Inventory (LEI), Classroom Environment Scale (CES), Individualised Classroom Environment Questionnaire (ICEQ) and College and University Classroom Environment Inventory (CUCEI) – and then moving on to various widely-used ones before ending the segment with the main instrument which I selected for my study – What Is Happening In this Class? (WIHIC).

Table 2.1 provides a summary of the scales used in each instrument, including the name of each scale in each instrument, the level (primary, secondary, higher education) for which the instrument is appropriate, and the number of items in each scale. This table also classifies individual scales according to Moos' (1974) scheme for classifying human environments: Relationship Dimensions (involving the nature and intensity of personal relationships within the environment and the extent to which people are involved in the environment and the support and help for each other); Personal Development Dimensions (involving basic directions along which personal growth and self-enhancement tend to occur); and System Maintenance and System Change Dimensions (involving the extent to which the environment is orderly, clear in expectations, maintains control and is responsive to change).

Table 2.1
Overview of Scales Contained in Some Classroom Environment Instruments (LEI, CES, ICEQ, CUCEI, MCI, QTI, SLEI, CLES, WIHIC, TROFLEI and COLES)

			Scales Classified According to Moos' Scheme		
Instrument	Level	Items per Scale	Relationship Dimensions	Personal Development Dimensions	System Maintenance and Change Dimensions
Learning Environment Inventory (LEI)	Secondary	7	Cohesiveness Friction Favouritism Cliqueness Satisfaction Apathy	Speed Difficulty Competitiveness	Diversity Formality Material Environment Goal Direction Disorganisation Democracy
Classroom Environment Scale (CES)	Secondary	10	Involvement Affiliation Teacher Support	Task Orientation Competition	Order and Organisation Rule Clarity Teacher Control Innovation
Individualised Classroom Environment Questionnaire (ICEQ)	Secondary	10	Personalisation Participation	Independence Investigation	Differentiation
College and University Classroom Environment Inventory (CUCEI)	Higher Education	7	Personalisation Involvement Student Cohesiveness Satisfaction	Task Orientation	Innovation Individualisation
My Class Inventory (MCI)	Elementary	6–9	Cohesiveness Friction Satisfaction	Difficulty Competitiveness	
Questionnaire on Teacher Interaction (QTI)	Secondary/ Primary	8–10	Leadership Helpful/Friendly Understanding Student Responsibility and Freedom Uncertain Dissatisfied Admonishing Strict		
Science Laboratory Environment Inventory (SLEI)	Upper Secondary/ Higher Education	7	Student Cohesiveness	Open-Endedness Integration	Rule Clarity Material Environment
Constructivist Learning Environment Survey (CLES)	Secondary	7	Personal Relevance Uncertainty	Critical Voice Shared Control	Student Negotiation
What Is Happening In this Class? (WIHIC)	Secondary	8	Student Cohesiveness Teacher Support Involvement	Investigation Task Orientation Cooperation	Equity
Technology-Rich Outcomes-Focused Learning Environment Inventory (TROFLEI)	Secondary	10	Student Cohesiveness Teacher support Involvement Young Adult Ethos	Investigation Task Orientation Cooperation	Equity Differentiation Computer Usage
Constructivist-Oriented Learning Environment Survey (COLES)	Secondary	11	Student Cohesiveness Teacher Support Involvement Young Adult Ethos Personal Relevance	Task Orientation Cooperation	Equity Differentiation Formative Assessment Assessment Criteria

Source: Fraser (2012)

2.3.1 Learning Environment Inventory (LEI)

The LEI (mentioned earlier) was developed in the 1960s as part of the evaluation and research on Harvard Project Physics (Fraser, Anderson & Walberg, 1982; Walberg & Anderson, 1968). This instrument evolved from the 18-scale Classroom Climate Questionnaire that was developed by Walberg (1968). The final version comprised 15 dimensions with a total of 105 statements (seven items per scale) that describe the typical classroom. These dimensions were considered good predictors of learning and were relevant to social psychology at the time. There are four Likert-type response alternatives for each item – Strongly Disagree, Disagree, Agree and Strongly Agree – with the scoring direction (or polarity) reversed for some items.

2.3.2 Classroom Environment Scale (CES)

The CES evolved from Moos' research conducted in several settings, including psychiatric hospital wards, prisons, school classrooms, university residences and workplace environments. The final version comprises nine scales with 10 items of True/False response format and with the scoring direction reversed for many items. It was developed to assess the psychosocial environment of school classrooms from the perspective of the interaction between participants, including teacher–student and student–student interactions, and teacher–exhibited behaviour (Moos & Trickett, 1974, 1987).

2.3.3 Individualised Classroom Environment Questionnaire (ICEQ)

The ICEQ assesses those dimensions which distinguish individualised classrooms from conventional ones. Guided by the literature on individualised, open and inquiry-based education, extensive interviews with teachers and secondary school students, and reactions to draft versions sought from selected experts, teachers and junior high school students, Rentoul and Fraser (1979) developed the original version comprising five scales, each with 15 items. This evolved into the final version (Fraser, 1990)

of 50 items with an equal number of items belonging to each of the five scales. For each item, a five-point frequency scale was used with response alternatives of Almost Never, Seldom, Sometimes, Often and Very Often. The scoring direction is reversed for many of the items.

2.3.4 College and University Classroom Environment Inventory (CUCEI)

The CUCEI was developed to assess the classroom environment of small higher-education classes of up to 30 students (Fraser & Treagust, 1986; Fraser, Treagust & Dennis, 1986). The initial version comprised scales adapted from some secondary classroom instruments – mainly, the LEI, CES and ICEQ. This evolved to form the final version which comprised seven scales, each containing seven items. For each item, there are four Likert-type response alternatives – Strongly Agree, Agree, Disagree, and Strongly Disagree. The scoring direction is reversed for approximately half of the items.

Fraser, Williamson and Tobin (1987) used the CUCEI successfully with 546 students in 45 high school classes to identify more involvement, satisfaction, innovation and individualisation in alternative schools. When Logan, Crump and Rennie (2006) used the CUCEI in computing classrooms in New Zealand, they found that its psychometric performance was not ideal.

Following these instruments, other key questionnaires have emerged on the scene, including in Asia, such as the My Class Inventory (MCI), the Questionnaire on Teacher Interaction (QTI), Science Laboratory Environment Inventory (SLEI), Constructivist Learning Environment Survey (CLES), Technology-Rich Outcomes-Focused Learning Environment Inventory (TROFLEI), and What Is Happening In this Class? (WIHIC) questionnaire. The latter is of particular interest for my study.

2.3.5 My Class Inventory (MCI)

The MCI is a simplified version of the LEI designed for use among children aged 8–12 years (Fisher & Fraser, 1981; Fraser, Anderson & Walberg, 1982; Fraser & O'Brien, 1985). The original intent for this instrument was for use at the primary school level, but it has also been found to be useful for junior high and even high school students with limited reading ability.

The difference between this instrument and its predecessor (the LEI) lies in four significant ways. The MCI takes into account fatigue and shorter attention span among younger children and minimises this by:

i. reducing the original 15 scales of the LEI to only five scales
ii. simplifying the wording to enhance readability
iii. reducing the LEI's four-point response format to a two-point(Yes/No) response
iv. allowing students to answer on the questionnaire itself, instead of on a separate response sheet, to minimise errors in transferring responses from one place to another.

The final version of the MCI has 38 items in the five scales.

The MCI has been successfully administered in several studies, all of which supported its validity and usefulness. Goh, Young and Fraser (1995) modified the traditional Yes/No response to a three-point frequency response format (Seldom, Sometimes, Most of the Time), included a Task Orientation scale and administered the MCI to 1512 primary five mathematics students in Singapore. Not only did the study provide support for the validity and reliability of the MCI, but it also revealed associations between outcomes and environment and supported the usefulness of incorporating two data analysis methods (multiple linear regression and hierarchical linear modelling) in learning environment research.

Majeed, Fraser and Aldridge (2002) modified the MCI and used it with 1565 lower-secondary mathematics students in 81 classes in 15 government schools in Brunei. The study established the factorial validity of a refined three-scale version of the MCI assessing cohesiveness, difficulty and competition. Also, each scale displayed satisfactory internal consistency reliability and discriminant validity and was able to differentiate between the perceptions of students in different classes. Students generally perceived a positive learning environment in mathematics classes, although boys and girls held different perceptions of the same classroom. Associations between student satisfaction and the learning environment were also statistically significant for most MCI scales.

Mink and Fraser (2005) used the MCI with 120 grade 5 mathematics students in Florida to determine the extent to which the implementation of a project (Project SMILE) in classrooms positively influenced the classroom environment and student attitudes towards reading, writing and mathematics. Once again, the study affirmed the validity and reliability of the MCI. In addition, the actual form of most MCI scales was capable of differentiating between the perceptions of students in different classes. The implementation of SMILE had a positive impact on the students in that their attitudes to mathematics and reading improved. Their study also replicated previous research in that students' satisfaction was greater in classrooms with a more positive learning environment (measured by the scales of the MCI), especially in terms of student cohesiveness.

Sink and Spencer (2005) cross-validated a revised version of the MCI with a large sample of 2835 grade 4–6 students in an urban school district in Washington state, providing strong support for the validity and reliability of the revised version.

Scott Houston, Fraser and Ledbetter (2008) used the MCI with a sample of 588 grade 3–5 students in Texas to evaluate the effectiveness of the instructional alternatives of using a textbook, science kits or both. Support for the factorial validity and reliability of the MCI was provided. Results revealed

that using science kits was associated with a more positive learning environment in terms of student satisfaction and cohesiveness, and that higher student satisfaction was found in classrooms with greater cohesiveness and less friction and competition.

2.3.6 Questionnaire on Teacher Interaction (QTI)

The QTI is based on a theoretical model of proximity (cooperation–opposition) and influence (dominance–submission) and was developed to assess student perceptions of eight teacher behaviour aspects. This stemmed from research originating in The Netherlands which focused on the nature and quality of interpersonal relationships between teachers and students (Creton, Hermans & Wubbels, 1990; Wubbels, Brekelmans & Hooymayers, 1991; Wubbels & Levy, 1993). The original Dutch version of the QTI consisted of items in eight scales, with each item on the scale scored with a five-point frequency response scale ranging from Never to Always (Wubbels & Levy, 1993). The instrument has been translated into several languages: Dutch, English, French, German, Hebrew, Russian, Slovenian, Swedish, Norwegian, Finnish, Spanish, Mandarin Chinese, Singapore Chinese and Indonesian. It also formed the basis for several new versions – e.g. the Malay version for primary education used by Scott and Fisher (2004).

Research with the QTI first involved senior high school students but this was extended to cross-validation and comparative work completed at various grade levels as evidenced in Wubbels and Levy's (1991) study. They used the 64-item version of the QTI with 1606 students and 66 teachers in the USA. Cross-cultural validity and usefulness were confirmed. Later, also in the USA, Wubbels and Levy (1993) developed a short 48-item version of the QTI in English with the intention of offering school teachers a way to obtain feedback on their own interpersonal relationships within the classroom. This study also provided validity and reliability support for the QTI.

The QTI was also used in several other countries. In Australia, Fisher, Henderson and Fraser (1995) administered the QTI to 489 Australian

students in 28 biology classes in senior high school. The study attested to the validity and reliability of the QTI.

In Singapore, Goh and Fraser (1996, 1998) developed a more economical 48-item version of the QTI and an adapted form of the MCI and used both questionnaires with 1512 students in 39 grade 5 mathematics classes in Singapore. Statistical analyses provided good support for reliability of five out of the eight scales used (Leadership, Helping/Friendly, Understanding, Dissatisfied and Admonishing), with reliability coefficients of around 0.90 for class means.

The QTI became widely used as it allowed investigations into student perceptions about the relationship of the teacher with the students as a class, rather than relationships with individual students. Den Brok, Brekelmans and Wubbels (2006) used the QTI with 59 classes of 29 teachers to reveal that teachers on average were perceived to have more Influence and more Proximity in their relations with individual students as compared to their relationship with the whole class.

Several studies using the QTI in science education classrooms to investigate associations between teacher–students relationships and student outcomes seem to indicate medium to strong relations between student outcomes and student perceptions of teacher–students relationships. Wubbels, Brekelmans, den Brok and van Tartwijk (2006) reported that relationships are stronger for affective than for cognitive outcomes. These studies showed positive relationships between student perceptions of leadership, helpful/friendly and understanding behaviours and student attitudes and student achievement. On the other hand, negative relationships surfaced for teacher interpersonal behaviour and student outcomes, confirming earlier findings about the effectiveness of direct instruction strategies as reported by Brophy and Good (1986).

The QTI has proven itself to be valuable in research. Wubbels et al. (2006) puts this down to the QTI's strong factorial structure, noting the QTI's

practical usefulness in terms of time, cost, administration, scoring and low intrusiveness of the process. In addition, Wubbels and Brekelmans (2012) offer a comprehensive review of studies using the QTI and the variety of research applications with these studies (e.g. associations between teacher–students relationships and student outcomes and between teaching styles and student outcomes).

2.3.7 Science Laboratory Environment Inventory (SLEI)

This instrument was specifically developed to take into account the critical importance and uniqueness of laboratory settings in science education by assessing the environment of science laboratory classes at the senior high school or higher education levels (Fraser, Giddings & McRobbie, 1995; Fraser & McRobbie, 1995; Fraser, McRobbie & Giddings, 1993). The SLEI consists of five scales (each with seven items) and a five-point frequency response format – Almost Never, Seldom, Sometimes, Often and Very Often. An Open-Endedness scale was included to accommodate the importance claimed for open-ended laboratory activities in the literature (e.g. Hodson, 1988).

The initial version of the SLEI was a class form for measuring an individual student's perceptions of the whole class. This was field-tested and validated simultaneously in six different countries (the USA, Canada, England, Israel, Australia and Nigeria) with a sample of 4643 students in 225 laboratory classes. A personal form was also designed to measure the individual student's perceptions of his or her own role within the class. This was field-tested and validated simultaneously with a sample of over 5447 students in 269 classes in the same six countries (the USA, Canada, England, Israel, Australia and Nigeria).

Since then, the SLEI has been cross-validated and used successfully in the following studies: Fraser and McRobbie (1995) with 1594 students in 92 classes in Australia; Wong and Fraser (1996) with 1592 grade 10 chemistry students in Singapore; and Fisher, Henderson and Fraser (1997) with 489

senior high school biology students in Australia. More recently, when the SLEI was used in eastern USA with 761 high school biology students from 25 classes, Lightburn and Fraser (2007) found it to be valid and reliable for use within the context of the study.

The SLEI was also cross-validated in Asian countries in more recent years. In Singapore, Quek, Wong and Fraser (2005) used the SLEI with 497 final-year gifted and non-gifted chemistry students (around 15 to 16 years of age). Data analysis attested to the validity, reliability and usefulness of the SLEI in this context.

In Korea, Fraser and Lee (2009) also successfully used and cross-validated the SLEI. The questionnaire was first translated into Korean language and then used with 439 high school science students divided among three streams (science-independent, science-oriented and humanities). Once again, the SLEI proved to be valid and useful for use within the context of the study.

2.3.8 Constructivist Learning Environment Survey (CLES)

This instrument incorporates a constructivist approach in which meaningful learning is viewed as a cognitive process in which individuals make sense of the world in relation to the knowledge which they already have constructed. This sense-making process involves active negotiation and consensus building. The CLES was thus developed to help educators to assess a classroom environment's consistency with this pedagogical view, reflect on their own pedagogical assumptions and reframe their teaching practices (Taylor, Fraser & Fisher, 1997). The CLES was first validated by Taylor et al. (1997) with samples of 494 Australian 13-year-olds in 41 grade 8 and 9 classes in 13 schools and 1600 grade 9–12 science students in Texas.

The CLES has 36 items with five frequency response alternatives that range from Almost Never to Almost Always and it assesses either student or teacher perceptions of Personal Relevance, Uncertainty, Student Negotiation,

Shared Control and Critical Voice. Johnson and McClure (2004) developed a shortened and revised version of the CLES (CLES 2) with 20 items in the same five scales, but with four items per scale instead of six. Items worded in the negative were also removed. The CLES 2 was validated with 290 upper elementary, middle and high school science teachers, both inservice and preservice, in Minnesota, USA.

The CLES has been validated in a number of studies and in a number of countries. In South Africa, Aldridge, Fraser and Sebela (2004) modified the CLES and administered it to 1864 intermediate and senior level learners in 43 classes in 6 schools. The Critical Voice scale was omitted to suit the context of the study. The a priori factor structure was confirmed for the CLES (which includes 24 items in the actual or preferred form, with 6 items in each of the four scales of Personal Relevance, Uncertainty, Shared Control and Student Negotiation). The study reported students' preference for a more student-centred learning environment and that the CLES was useful for providing feedback that can guide teachers in orientating their classrooms towards a more constructivist approach.

In Florida, Spinner and Fraser (2005) administered the CLES to two separate samples of 53 and 66 fifth-grade mathematics from 6 classes with the intention of assessing the level of constructivistic teaching and learning practices. Data analyses supported the CLES's factor structure, internal consistency reliability, discriminant validity and the ability to distinguish between classes.

In a cross-national study, Aldridge, Fraser, Taylor and Chen (2000) used the CLES with 1081students from 50 classes in Australia and 1879 students from 50 classes in Taiwan. Data analysis supported each scale's internal consistency reliability, factor structure and ability to differentiate between classrooms, as well as revealing interesting differences between Taiwan and Australia in average scale scores.

In Miami, Florida, USA, Peiro and Fraser (2009) modified the CLES and translated it into Spanish. They used it with 739 grade K–3 science students both in the English and Spanish versions. Statistical analyses supported the validity of the CLES within the context of the study. Strong and positive associations were found between students' attitudes and the nature of the classroom environment.

In Texas, Nix, Fraser and Ledbetter (2005) developed and administered a new form of the CLES (Comparative Student version, CLES–CS) and administered it to 1079 students in 59 classes. The intention was to evaluate the impact of an innovative teacher development programme based on the Integrated Science Learning Environment (ISLE) model. In this study, the a priori structure of the CLES–CS was confirmed. The internal consistency reliability, discriminant validity and the ability to distinguish between classes and groups were also supported. The study provided support for promoting constructivist-oriented teaching in classrooms, especially in the areas of relevance of teaching and uncertainty of science.

The CLES was also translated and used in various countries (Fraser, 2012). In Korea, the CLES was translated into the Korean language and administered to 1083 science students in 24 classes in 12 schools. The five-factor structure was retained and replicated for the translated version of both an actual and preferred form of CLES. Outcome–environment associations were reported.

In Singapore, the CLES was expanded (with two new scales added – Political Awareness and Ethic of Care) and modified for use among tertiary students taking an English course (Wilks, 2000). The modified instrument, the General Paper Constructivist Learning Environment Survey (GPCLES), was administered to 1046 students in 48 junior colleges. The CLES was found to be valid and reliable and each scale differentiated significantly between the perceptions of students in different classrooms.

2.3.9 Technology-Rich Outcomes-Focused Learning Environment Inventory (TROFLEI)

For some time now, outcomes-focused education has been adopted by many schools in the reform of school practices. Planning, delivery and assessment are all focused on the students' outcomes/results as a result of teaching, in contrast to the past when the focus was on covering the syllabus or curriculum. The TROFLEI was thus innovatively designed to account for this.

Developed by Aldridge and Fraser (2008), the TROFLEI was field-tested and validated in a study involving an innovative new post-secondary school, whose emphases included an outcomes focus and the use of ICT in programme delivery, during its first year of operation. The TROFLEI comprises of a total of 80 items, with eight items in each of eight scales that are scored using a five-point frequency response format – Almost Never, Seldom, Sometimes, Often and Almost Always. In addition to its unique slant in assessing the learning environment, the TROFLEI also has an innovative aspect in that it employs a side-by-side response format which enables respondents to indicate their separate perceptions of actual and preferred classroom environment in an economical way.

The instrument has since been validated and used successfully in the following studies: Aldridge, Dorman and Fraser (2004) with a sample of 1249 students, of whom 772 were from Western Australia 477 were from Tasmania; Dorman and Fraser (2009) with 4146 grade 8–13 students in an Australian study of associations between students' affective outcomes and their classroom environment perceptions; and Aldridge and Fraser (2008) with 2317 students in investigating differences in classroom environment perceptions between males and females and between students enrolled in university-entrance examinations and in wholly school-assessed subjects.

More recent studies emerged as well. Koul, Fisher and Shaw (2011) used both the actual and preferred forms of the TROFLEI in New Zealand with 1027 high-school students from 30 classes. In this study, the TROFLEI was

found to be valid and reliable within the context and statistically significant associations were found between the scales of the TROFLEI and three affective outcome scales used in the study – attitude to subject, attitude to computers and academic efficacy.

Welch, Cakir, Peterson and Ray (2012) undertook a study to establish the cross-cultural reliability and validity of the TROFLEI in Turkey and the USA. The TROFLEI was translated into the Turkish language for use in Turkey and used with 980 grade 9–12 students. The English version was used with 130 grade 9–12 students in the USA. This study attested to the validity and the reliability of the TROFLEI, with confirmatory factor analyses providing evidence for the TROFLEI being valid across both samples for both actual and preferred responses.

2.3.10 What Is Happening In this Class? (WIHIC)

This instrument is of particular interest to my study. First developed by Fraser, McRobbie, and Fisher (1996), the WIHIC questionnaire combines salient scales from a wide range of modified existing questionnaires with additional scales to encompass contemporary educational aspects such as equity and constructivism. Refinements to this instrument led to the final form containing seven eight-item scales – Student Cohesiveness, Teacher Support, Involvement, Investigation, Task Orientation, Cooperation and Equity. It has a five-point frequency response scale ranging from Almost Never to Very Often. In addition, the WIHIC has a separate Class form (which assesses a student's perceptions of the class as a whole) and Personal form (which assesses a student's personal perceptions of his or her role in a classroom). The WIHIC gained popularity over the years around the world for use as a classroom environment instrument. This achievement is noted by Dorman (2008) who describes it as having "almost bandwagon status in the assessment of classroom environments" (p. 181).

Fraser, Fisher and McRobbie (1996) initially developed a 90-item version and later refined it as a result of statistical analysis of data from 355 junior high

school science students, as well as extensive interviews with students about their views of their classroom environments in general, the wording and salience of individual items and their questionnaire responses. This led to a 54-item version in seven scales, although this set of items was expanded to 80 items in eight scales for the second version of the WIHIC which was field-tested with junior high school science classes in Australia and Taiwan. Both the English and the Chinese versions were used (with the Chinese version being submitted to rigorous procedures of translation and back translation). The English version was used with 2081 Australian students in 50 classes and the Chinese version with 1879 Taiwanese students in 50 classes. This led to the WIHIC's final form of the seven eight-item scales as described by Aldridge, Fraser and Huang (1999). Strong factorial validity and internal consistency reliability, as well as the ability of each scale to differentiate significantly between the perceptions of students in different classrooms, were reported (Aldridge & Fraser, 2000).

Table 2.2 provides a scale description and a sample item for each of the six WIHIC scales used in my study.

Table 2.2
Scale Description and Sample Item for Each Scale in the Modified What Is Happening In this Class? (WIHIC) Questionnaire

Scale	Description	Sample item
	The extent to which …	
Student Cohesiveness	Students are friendly and supportive of each other.	I make friendships among students in this class.
Teacher Support	The teacher helps, befriends and is interested in students.	The teacher considers my feelings.
Involvement	Students have attentive interest, participate in discussions and enjoy the class.	I discuss ideas in class.
Task Orientation	It is important for students to complete activities planned and to stay on the subject matter.	Getting a certain amount of work done is important to me.
Cooperation	Students cooperate with each other during activities.	When I work in this class, there is teamwork .
Equity	The teacher treats students equally, including distributing praise, questions and opportunities to be included in discussions.	The teacher gives as much attention to my questions as to other students' questions.

*All items used the response alternatives of Almost Never, Seldom, Sometimes, Often and Almost Always
Adapted from Afari, Aldridge, Fraser and Khine (2013)

Dorman's (2003) study reinforces the use of the WIHIC with a comprehensive and impressive validation. This study involved a cross-national sample of 3980 high school students from Australia, the UK and Canada. Confirmatory factor analysis confirmed and supported the seven-scale a priori structure and statistical analysis indicated that the model was a good fit to the data. The use of multi-sample analyses within structural equation modelling substantiated invariant factor structures for the grouping variables used – country, grade level and sex. This study supported the "wide international applicability of the WIHIC as a valid measure of classroom psychosocial environment" (p. 231).

Dorman (2008) undertook a second study, this time using both the actual and preferred forms of the WIHIC with a sample of 978 secondary school students in Australia. Again, factor analyses (undertaken separately for the actual and preferred forms) supported the seven-scale a priori structure and indicated that the model was a good fit to the data. The use of multitrait–multimethod modelling with the seven scales as traits and two forms of the instrument as methods supported the WIHIC's construct validity. This research further provided strong evidence for the "sound psychometric properties of the WIHIC" (p.179).

Table 2.3 lists 22 studies which have made use of the WIHIC in various countries (including Asia) and in various languages. The first four studies are of a cross-national nature and were conducted in Australia and Taiwan in two languages by Aldridge and Fraser (2000), Australia, the UK and Canada in English by Dorman (2003), in Australia and Indonesia in two languages by Fraser, Aldridge and Adolphe (2010) and in Australia and Canada by Zandvliet and Fraser (2005). The next six studies involved administration of the WIHIC in English. These included Chionh and Fraser (2009), Khoo and Fraser (2008) and Peer and Fraser (in press) in Singapore; Koul and Fisher (2005) in India; Dorman (2008) in Australia; and Aldridge, Fraser and Ntuli (2009) in South Africa.

Table 2.3
Overview of Studies that have Involved the Use of the WIHIC

Reference(s)	Country(ies)	Language(s)	Sample(s)	Factorial Validity & Reliability	Associations with Environment for:	Unique Contributions
Aldridge, Fraser & Huang (1999); Aldridge & Fraser (2000)	Australia Taiwan	English Mandarin	1081 (Australia) & 1879 (Taiwan) junior high science students in 50 classes	✓	Enjoyment	Mandarin translation Combined quantitative and qualitative methods
Dorman (2003)	Australia UK Canada	English	3980 high school students	✓	NA	Confirmatory factor analysis substantiated invariant structure across countries, grade levels & sexes.
Fraser, Aldridge & Adolphe (2010)	Australia Indonesia	English Bahasa	567 students (Australia) and 594 students (Indonesia) in 18 secondary science classes	✓	Several attitude scales	Differences were found between countries and sexes.
Zandvliet & Fraser (2004 2005)	Australia Canada	English	1404 students in 81 networked classes	✓	Satisfaction	Involved both physical (ergonomic) and psychosocial environments
Chionh & Fraser (2009)	Singapore	English	2310 grade 10 geography & mathematics students	✓	Achievement Attitudes Self-esteem	Differences between geography & mathematics classroom environments were smaller than between actual & preferred environments.
Khoo & Fisher (2008)	Singapore	English	250 working adults attending computer education courses	✓	Satisfaction	Adult population Males perceived more trainer support & involvement but less equity.
Peer & Fraser (in press)	Singapore	English	1081 primary school students in 55 classes	✓	Two attitude scales (Inquiry & Enjoyment)	Differences in learning environment according to sex, grade level and stream
Koul & Fisher (2005)	India	English	1021 science students in 31 classes	✓	NA	Differences in classroom environment according to cultural background
Dorman (2008)	Australia	English	978 secondary school	✓	NA	Multitrait–multimethod modelling

			students			validated actual and preferred forms.
Aldridge, Fraser & Ntuli (2009)	South Africa	IsiZulu	1077 grade 4–7 students	✓	NA	Preservice teachers undertaking a distance-education program used environment assessments to improve teaching practices.
Kim, Fisher & Fraser (2000)	Korea	Korean	543 grade 8 science students in 12 schools	✓	Attitudes	Korean translation Sex differences in WIHIC scores
Wahyudi & Treagust (2004)	Indonesian	Indonesian	1400 lower-secondary science students in 16 schools	✓	NA	Indonesian translation Urban students perceived greater cooperation & less teacher support than suburban students.
MacLeod & Fraser (2010)	UAE	Arabic	763 college students in 82 classes	✓	NA	Arabic translation Students preferred a more positive actual environment.
Afari et al. (2013)	UAE	Arabic	352 college students in 33 classes	✓	Enjoyment Academic efficacy	Arabic translation Use of games promoted a positive classroom environment.
den Brok et al. (2006)	California, USA	English	665 middle-school science students in 11 schools	✓	NA	Girls perceived the environment more favourably.
Martin-Dunlop & Fraser (2008)	California, USA	English	525 female university science students in 27 classes	✓	Attitude	Very large increases in learning environment scores for an innovative course
Ogbuehi & Fraser (2007)	California, USA	English	661 middle-school mathematics students	✓	Two attitude scales	Used 3 WIHIC & 3 CLES scales Innovative teaching strategies promoted task orientation.
Wolf & Fraser (2008)	New York, USA	English	1434 middle-school science students in 71 classes	✓	Attitudes Achievement	Inquiry-based laboratory activities promoted cohesiveness & were differentially effective for males and females.

Pickett & Fraser (2009)	Florida, USA	English	573 grade 3–5 students	✓	NA	Mentoring program for beginning teachers was evaluated in terms of changes in learning environment in teachers' school classrooms.
Allen & Fraser (2007)	Florida, USA	English Spanish	120 parents and 520 grade 4 & 5 students	✓	Attitudes Achievement	Involved both parents and students Actual-preferred differences were larger for parents than students.
Robinson & Fraser (2013)	Florida, USA	English Spanish	78 parents and 172 kindergarten science students	✓	Achievement Attitudes	Kindergarten level Involved parents Spanish translation Relative to students, parents perceived a more favourable environment but preferred a less favourable environment.
Helding & Fraser (2013)	Florida, USA	English Spanish	924 students in 38 grade 8 & 10 science classes	✓	Attitudes Achievement	Spanish translation Students of NBC teachers had more favourable classroom environment perceptions.

Adapted from Fraser (2012)

The WIHIC has been translated into several languages as well. In the eleventh and twelfth studies, it was translated in the Korean language and administered in Korea by Kim, Fisher and Fraser (2000). In the next study, the WIHIC was translated in the Indonesian language and administered in Indonesia by Wahyudi and Treagust (2004). The next two studies made use of Arabic translations of the WIHIC which were administered in the United Arab Emirates by MacLeod and Fraser (2010) and Afari and colleagues (2013).

The last eight studies were undertaken in the USA: in California by den Brok, Fisher, Rickards and Bull (2006), Martin-Dunlop and Fraser (2007) and Ogbuehi and Fraser (2007); in New York by Wolf and Fraser (2008); and four studies in Florida by Pickett and Fraser (2009), Allen and Fraser (2007), Robinson and Fraser (2013) and Helding and Fraser (2013). The four studies in Miami involved the use of an English-language version of the WIHIC, but it is noted that that three of them provided the option of responding to a version of the WIHIC either in Spanish or in English.

For each of the studies listed in Table 2.3, details are provided of the country involved and language used, as well as the size and nature of the sample. It is especially noteworthy in relation to my study that every study listed reported evidence to support the factorial validity and internal consistency reliability of the WIHIC. The majority of these studies also provided evidence of the ability of the WIHIC to differentiate between the perceptions of students in different classrooms. The second last column of Table 2.3 identifies for which specific student outcomes the relationships between environment and outcomes were reported for each of the studies (where applicable). The last column identifies the unique contributions of each study. For example, the first entry shows Aldridge, Fraser and Huang's (1999) and Aldridge and Fraser's (2000) contributions involved a Mandarin translation for the WIHIC and using both quantitative and qualitative methods.

Numerous studies attest to the flexibility of the WIHIC in that its scales have been incorporated successfully into specific-purpose questionnaires customised to suit the particular contexts and purposes of the various studies. For example, Aldridge, Laugksch, Seopa and Fraser (2006) developed and validated a classroom environment instrument in the Sepedi language with 2638 grade 8 science students from 50 classes in 50 schools in South Africa for the purpose of monitoring the implementation of outcomes-based classroom environments.

The above studies substantiate the validity and usefulness of the WIHIC in a variety of learning environments and in various countries and languages. It is

also noteworthy that the WIHIC has been used several times in Asian countries (Indonesia, Korea, Taiwan and Singapore) and in their various languages, which makes it relevant and suitable for my study.

In addition, the WIHIC offers a generic and comprehensive range of dimensions for investigating the classroom environment. In the light of the new initiatives in Singapore mentioned in Chapter 1 (e.g. Teach Less, Learn More, STELLAR, etc), the WIHIC was suitable for use as it could draw out the 'voices' of the students to get a sense of students' engagement in the English Language classroom, which is very much in line with the new initiatives mentioned.

Of particular interest to this study also are the findings gleaned from Aldridge, Fraser and Huang's (1999) study which reported the use of this instrument with 50 classes from Taiwan and 50 classes from Australia. The research identified differences between the learning environments of these two countries. The study also revealed that the nature of the curriculum seemed to have been influenced by the learning environments established in that "the more examination-driven curriculum (led) to more teacher-centred approaches in the classroom" (Aldridge, Fraser & Huang, 1999, p. 60).This was evidenced in the way in which students in Taiwan reported the use of teacher-centred approaches as a result of the focus on examinations as compared to Australia.

This instrument shows much potential for capturing the cultural nuances embedded within the classroom. Comparisons across countries and across different contexts enhance the picture of the learning environment in general. Aldridge, Fraser and Huang (1999, p. 60) concluded their study by highlighting that "cross-cultural comparisons of this type have the potential to provide understanding of concepts as seen by those persons within the culture under study, ***generating new insights***" (emphasis mine).

2.4 Types of Learning Environment Research

The different questionnaires used in the study of learning environments arose from the different angles from which researchers have chosen to view the educational dynamics of the classroom and these, in turn, added to the different types of research on learning environments. In the sections below, I review past research in learning environments using the following organisation:

- Evaluation of Educational Innovations (Section 2.4.1)
- Combining Quantitative and Qualitative Research Methods (2.4.2)
- Cross-national Studies (2.4.3)
- Determinants of Classroom Environment: Sex and Ethnic Differences (2.4.4)
- Effects of Classroom Environment: Associations with Student Outcomes (Section 2.4.5).

2.4.1 Evaluation of Educational Innovations

Fraser (2007, p. 111) points out the value of classroom environment instruments "as a valuable source of process criteria in the evaluation of educational innovations". A scan of learning environment literature reveals that studies have been conducted in settings where a new technology or approach was introduced. Such studies have also been undertaken with the intention of evaluating the implementation and effectiveness of educational innovations, not just in Western countries, but also in Eastern parts of the world. These span across various subjects and different grade levels.

Table 2.3 lists some of such studies undertaken using the WIHIC. For example, Khoo and Fraser (2008) undertook a study in Singapore to evaluate adult computer application courses in terms of students' perceptions of their classroom learning environment. They administered the WIHIC to 250 adult learners in 23 classes and found that most of the students perceived high

levels of involvement, teacher support, task orientation and equity in their classroom learning environments. The effectiveness of the course differed, though, according to the age and sex of the students.

Wolf and Fraser (2008) used the WIHIC to evaluate the effectiveness of using inquiry-based laboratory activities in terms of learning environment, attitudes and achievement. They administered the WIHIC to 1434 middle-school science students in 71 classes. The study attested to the validity of the WIHIC and revealed that inquiry instruction promoted more student cohesiveness than non-inquiry instruction. Also, inquiry-based instruction was differentially effective for male and female students.

Nix, Fraser and Ledbetter (2005) used the CLES to evaluate an innovative science teacher development programme (based on the Integrated Science Learning Environment model). The researchers evolved a side-by-side response format for the CLES so that students could provide their perceptions of THIS classroom (students' current class with the teacher who had experienced the professional development) and OTHER classroom (other classes taught by different teachers in the same school). This study with 445 students in 25 classes revealed that students of teachers who had experienced the professional development perceived their classrooms as having relatively higher levels of personal relevance and uncertainty relative to the comparison classes.

Aldridge and Fraser (2008) reported the use of the TROFLEI in monitoring the success of educational programmes aimed at promoting outcomes-focused and ICT-rich classroom learning environments at a Senior College. This study was undertaken with 2317 students from 166 classes in Tasmania and Western Australia. Changes in student perceptions of their classroom environments over four years supported the efficacy of the school's educational programmes in that changes were statistically significant. Moderate effect sizes ranging from 0.20 to 0.38 standard deviations emerged for seven of the ten TROFLEI scales.

Lightburn and Fraser (2007) used the SLEI with 761 high-school biology students in USA to evaluate the effectiveness of using anthropometric activities. They found that, relative to a comparison group, the anthropometry group had significantly higher scores on some SLEI and attitude scales.

2.4.2 Combining Quantitative and Qualitative Research Methods

Research has evolved to include a hybrid of qualitative and quantitative methods. Fraser and Tobin (1991) and Tobin and Fraser (1998) advocated moving beyond choosing between quantitative or qualitative methods to combining both methods, and they noted that progress has been made with respect to combining both quantitative and qualitative methods within the same study in classroom learning environment research.

In Taiwan and Australia, Aldridge and Fraser (2000) conducted a cross-national study of classroom environments using mixed methods. The WIHIC and a scale from TOSRA to assess enjoyment of science lessons were administered to 1081 grade 8 and 9 general science students from 50 classes in 25 schools in Western Australia and 1879 grade 7–9 students from 50 classes in 25 schools in Taiwan. The findings revealed that Australian students consistently perceived their environments more favourably than their Taiwanese counterparts. Taiwanese students, however, reported significantly more positive attitudes towards science than did Australian students. The researcher also collected qualitative data through classroom observations, interviews with the teachers and students and narrative stories written by the researchers. They concluded the study with three important points:

(1) While the classroom environments were found to be different in the two countries, the instrument (WIHIC and one scale from TOSRA) did not reflect the overall quality of the education.
(2) When interpreting the data for the scales of the WIHIC, there was a need to consider if the scales reflected the educational importance that the countries and cultures placed on them.

(3) It was necessary to exercise caution when comparing quantitative data from different countries because students in different countries could differ in their interpretations of the items in the instrument.

In Florida, Spinner and Fraser (2005) undertook a study with grade 5 students to evaluate the effectiveness of the Class Banking System (CBS), an innovative mathematics programme. Qualitative data, including classroom observations and student interviews, were used to enhance quantitative results. The qualitative data supported the effectiveness of the CBS in improving elementary mathematics students' attitudes towards mathematics, perceptions of the classroom learning environment, and conceptual development.

In South Africa, Aldridge, Laugksch, Seopa and Fraser (2006) carried out a study to develop and validate a questionnaire that can be used to assess students' perceptions of their learning environment as a means of monitoring and guiding changes towards outcomes-based education. Statistical analyses supported the reliability and the validity of the instrument. In addition, qualitative data were also collected to enrich the quantitative data. Two case studies were used to investigate whether the profiles of class mean scores on the new instrument could provide an accurate and reliable description of the learning environment of individual science classes.

In South Florida, Allen and Fraser (2007) used the WIHIC with grade 4 and 5 students to investigate parents' and students' perceptions of science classroom learning environments. Associations were found between some learning environment dimensions (especially Task Orientation) and student outcomes (especially Attitudes). The use of qualitative methods suggested that students and parents were generally satisfied with the classroom environment, but that students would prefer more investigation while parents indicated a preference for more teacher support.

Fraser (2007) reported several studies that included qualitative data in research on learning environments. Fraser (2007, p. 113) identified one such

study which was able to provide qualitative information which "helped the researchers to provide consistent and plausible accounts of the profile of (the) teacher's scores on a classroom environment instrument to which her students responded". In this study, Teacher Support came out very strongly as an important aspect of the learning environment. Fraser (2007) also cited a few Asian studies which employed qualitative methods, such as interviews, to check the suitability of a learning environment instrument so that it could be modified before launching a large-scale study. A Korean study which made use of qualitative methods revealed findings that reflected the cultural youth–elder relationship in society in the classrooms. This is played out in teacher–student interactions in senior high school science classrooms (Lee, Fraser & Fisher, 2003). In Hong Kong, qualitative methods were also used in the form of open-ended questions to reveal that the most critical element in a positive classroom learning environment is the teacher (Wong, 1993, 1996).

2.4.3 Cross-National Studies

Learning environment research has also transcended national boundaries. Fraser (2012) draws out two important reasons for such studies. The first is that they allow greater variation in variables of interest because the sample originates from multiple countries. The second reason is that they call into question long-standing assumptions and beliefs about classroom practices. For example, an Australian and Taiwanese study (Aldridge, Fraser & Huang, 1999) used the WIHIC with 1879 Taiwanese students and 1081 Australian from 50 junior high school science classes in each country. Australian students consistently perceived their classroom environments more favourably than their Taiwanese counterparts on all scales of the WIHIC but, in contrast, Taiwanese students were found to have a more positive attitude towards their science classes. The study highlighted the influence of the learning environment on the nature of the curriculum. This was evidenced in the way in which students in Taiwan reported the use of teacher-centred approaches that resulted from the greater focus on examinations than in Australia. In addition, qualitative data provided valuable insights into the perceptions of students in the different countries. For example, different

students in both countries seemed to have different interpretations of some of the items in the WIHIC. This highlighted the need for caution when interpreting differences between the questionnaire results from two countries with cultural differences (Aldridge & Fraser, 2000).

Fraser, Aldridge and Adolphe (2010) undertook a cross-national study of classroom environments in Australia and Indonesia. They administered a modified version of the WIHIC to 1161 students from 18 science classes (594 students from Indonesia and 567 students from Australia). The study revealed some differences between countries and between sexes in students' perceptions of their classroom learning environments – Indonesian students perceived their learning environments significantly more positively than did their Australian counterparts for the Involvement and Investigation scales. However, for Task Orientation and Equity, Australian students had significantly more positive perceptions of their classroom environment than Indonesian students. The study also identified a statistically significant country–by–sex interaction for one learning environment scale – Student Cohesiveness. Further cross-national studies involving the WIHIC that are listed in Table 2.3 are Dorman (2003) and Zandvliet and Fraser (2004, 2005).

A cross-national study was also undertaken in Singapore and Australia by Fisher, Goh, Wong and Rickards (1997) who used the QTI with students and teachers from 20 secondary science classes from 10 schools in each of the countries. The study revealed that, compared to Singaporean teachers, Australian teachers were perceived to give more responsibility and freedom to their students. Singapore teachers were also perceived to be stricter than their Australian counterparts.

2.4.4 Determinants of Classroom Environment: Sex and Ethnic Differences

Fraser (2007) noted that learning environment studies have revealed how the classroom environment varies with factors such as teacher personality, class size, grade level, subject matter, the nature of the school-level environment, and the type of school. Of these, student gender has taken the most

prominence, with studies showing that females typically have more favourable views of their classroom learning environments than do males. A scan of literature on learning environment shows that research on sex differences has been undertaken in numerous countries, including Singapore. My study investigated sex differences in students' perceptions of the EL learning environment, as well as ethnic differences in perceptions. Hence, in this section, I review literature covering sex differences (Section 2.4.4.1) and ethnic differences (Section 2.4.4.2).

2.4.4.1 Sex Differences

Research in this area has been conducted in various educational and cultural contexts and includes several well-established studies which revealed statistically significant different perceptions for males and females. Owens and Straton's (1980) research revealed that females preferred cooperation more than males, but males preferred competition and individualisation more than females. In another study, males were found to prefer friction, competitiveness and differentiation more than females, while girls were found to prefer teacher structure, personalisation and participation more than boys (Byrne, Hattie & Fraser, 1986).

In Korea, Kim, Fisher and Fraser (2000) translated the WIHIC into the Korean language and administered it to 543 grade 8 science students in 12 schools. They found that boys perceived more teacher support, involvement, investigation, task orientation and equity than did girls.

In Brunei, the WIHIC was used successfully in several studies of sex differences. Khine (2001) used both the QTI and the WIHIC with 1188 Form 5 secondary school students in 54 classes to investigate the nature of the science learning environment. Statistically significant sex differences in students' perceptions of interpersonal teacher behaviour and classroom environment were found.

In Singapore, Quek, Wong and Fraser (2005) investigated teacher–student interactions and perceptions of the laboratory learning environment among 497 gifted and non-gifted secondary-school students. Sex differences were found in actual and preferred chemistry laboratory classroom environments and teacher–student interactions. Stream (gifted and non-gifted) differences were found in actual and preferred chemistry laboratory classroom environments and teacher–student interactions.

In California, Ogbuehi and Fraser (2007) used a modified version of the actual form of the CLES and WIHIC with 661 middle-school students from 22 classrooms in four inner-city schools. There was a small but statistically significant difference between the sexes for two scales (Student Negotiation and Task Orientation). Female students had more favourable perceptions of mathematics classrooms than their male counterparts, and there were no statistically significant differences between males and females in achievement and attitude to mathematics.

In China, Liu and Fraser (2013) developed a new learning environment instrument (the English Classroom Environment Inventory, ECLEI) and administered it to 1235 high school students in English classrooms. The study revealed sex differences in students' perceptions of the English classroom learning environment. Generally, female students tended to have more favourable perceptions of their classroom environments than their male counterparts.

The findings in this area tend to support the pattern that females typically have more positive perceptions of classroom environments than their male counterparts (Fisher, Fraser & Rickards, 1997; Fraser, Giddings & McRobbie, 1995; Henderson, Fisher & Fraser, 1995; Goh, Young & Fraser, 1995; Majeed, Fraser & Aldridge, 2002), although there are also counter-examples involving studies which reported that males perceived some aspects of their learning environment more positively than their female counterparts (Fraser, Aldridge & Adolphe, 2010; Peer & Fraser, in press).

2.4.4.2 Ethnic Differences

There has been some interest in research into ethnic differences in learning environment perceptions. Ethnicity is a complex construct that is influenced by many factors (political, social, etc.). In many learning environment studies, ethnicity was viewed primarily as a perceivable distinction (physical, conceptual or social) that exists amongst a group and which is used to ascribe status or to categorise the members of a group in a given population. Eriksen (2002) used the term 'culture' to refer to the perspectives (values, worldviews, etc.), practices and products of a social group that define how this group interprets and interacts with others. Following this line of thought, 'ethnicity' can be used to refer to social groups with a shared history, sense of identity, geography and cultural roots (Eriksen, 2002). Except for the element of geography, the rest can be applied to ethnicity as used in this study.

Specifically, this study investigated the two majority races in Singapore – Chinese and Malay. The race status of the student is accorded at birth. By default, he/she takes on the father's race, thereby assigning him/her to a social group with a shared history, a sense of identity and a set of cultural practices common to them. I investigated these two groups in terms of their perceptions of the learning environment.

Some research into ethnicity in the field of learning environment revealed interesting findings. Levy, den Brok, Wubbels and Brekelmans (2003) compared African-American students and Asian-American students and found that the former held more favourable perceptions of their teachers in terms of leadership, helpfulness and friendliness. The Asian-American counterparts, however, had less favourable perceptions, indicating that their teachers were stricter and gave them significantly less responsibility and freedom. These findings were surprising to the researchers because earlier studies had shown no differences between African-American students and their peers. The findings for Asian-American students were also surprising because they contradicted earlier studies in which Asians perceived less

dominance and more submissive behaviour (den Brok et al., 2002; Levy et al., 1997).

Hoang (2008) investigated different factors (grade level, sex, and ethnicity) that might affect the attitudes and learning environment perceptions of high school mathematics students in the US. The WIHIC and an attitude questionnaire based on the Test of Mathematics-Related Attitude (TOMRA) were administered to 600 grade 9 and 10 mathematics students in 30 classes in one high school. In terms of the key findings for ethnicity, Anglo students consistently reported more positive perceptions of classroom environment and attitudes than did their Hispanic counterparts.

Tulloch (2011) used the CLES and the TOSRA with 544 students in 29 tertiary classes in the US to investigate sex, age and ethnicity as determinants of classroom environment, as well as the effects of classroom environment on student attitudes. With regard to key findings on ethnicity, he found no significant differences between African-Americans and students of other ethnicities for any learning environment scale or for enjoyment. This confirmed an earlier study by Moss (2003) who found no ethnic (black versus non-black) differences in her classroom environment investigation in the US.

Findings are generally less consistent in the area of ethnicity differences, partly because of the complexity of such a construct. It is difficult to draw conclusive results because different groups tend to exhibit different responses in different contexts. However, because this does not diminish the importance of ethnicity as a construct for the learning environment, I investigated this aspect in the Singapore context.

2.4.5 Effects of Classroom Environment: Associations with Student Outcomes

Research focusing on associations between students' cognitive and affective learning outcomes and their perceptions of psychosocial characteristics of their classrooms could perhaps be considered the "strongest tradition" (Fraser, 2007, p. 110) in past learning environment research. These studies

have been undertaken in a variety of countries, covering a number of samples and spanning numerous school subjects.

Haertel, Walberg and Haertel (1981) conducted a meta-analysis involving 734 correlations from 12 studies involving 823 classes, eight subject areas, 17,805 students and four nations. Learning posttest scores and regression-adjusted gains were found to be consistently and strongly associated with cognitive and affective learning outcomes. Correlations were generally reported as being higher for older students and in studies using the class and school (instead of the individual) as the units of analysis. Better achievement on a variety of outcome measures was consistent in classes perceived as having greater Cohesiveness, Satisfaction and Goal Direction and less Disorganisation and Friction.

Walberg's (1981) multi-factor psychological model of educational productivity incorporates the psychosocial learning environment. This theory argues that learning is a function of student age, ability and motivation; of quality and quantity of instruction; and of the psychosocial environments of the home, the classroom, the peer group and the mass media. In the classroom context, this theoretically means that zero motivation or zero time for instruction results in zero learning. It is thus better to improve a factor that is the main hindrance to learning than to improve a factor that is already high. Fraser, Walberg, Welch and Hattie (1987) undertook extensive research syntheses involving correlations of learning with the factors in the model in order to make empirical probes of Walberg's (1981) model. Secondary analyses were also conducted with National Assessment of Educational Achievement data (Walberg, 1986) and National Assessment of Educational Progress data (Fraser et al., 1986; Walberg et al., 1986). Classroom and school environment was found to be a strong predictor of both achievement and attitudes even when a comprehensive set of other factors was held constant.

Fraser and Kahle (2007) investigated the effects of several types of environments on student outcomes using secondary analysis of a large database from a Statewide Systemic Initiative (SSI) in the USA. The study

spanned over three years and involved administering a questionnaire that assessed class, home and peer environments and student attitudes to nearly 7000 students in 392 middle-school science and mathematics classes in 200 different schools. Students also completed an achievement measure. Rasch analyses were conducted to provide comparable scale scores across student cohorts and across schools. Findings confirmed the importance of extending research on classroom learning environments to include the learning environments of the home and the peer group. All three environments accounted for statistically significant amounts of unique variance in student attitudes. However, only the class environment (defined in terms of the frequency of use of standards-based teaching practices) accounted for statistically significant amounts of unique variance in student achievement scores.

As my study specifically involved attitudes and efficacy as student outcomes, below I review relevant literature under two subsections:

- Associations with Attitudes (Section 2.4.5.1)
- Associations with Self-Efficacy (Section 2.4.5.2).

2.4.5.1 Associations with Attitudes

In South Florida, Allen and Fraser (2007) used the WIHIC with 520 grade 4 and 5 students in science classrooms as well as 120 parents. Associations were found between some learning environment dimensions (especially task orientation) and student outcomes (especially attitudes). Not only was the WIHIC found to be reliable and valid, but other key findings included a preference on the part of both parents and students for a more positive classroom environment than the one perceived to be actually present, but effect sizes for actual–preferred differences were larger for parents than for students.

In studies of associations between student attitude and the learning environment, the WIHIC frequently has been used. Table 2.3 detailed many

examples of the successful administration of WIHIC in various countries and in various languages that provide support for its validity and the reliability and for the existence of associations between student outcomes and the learning environment. Of interest in this section is the second last column of Table 2.3 which identifies the student outcomes for which a relationship between environment and outcomes has been reported for each study. Out of the 22 studies listed, 14 of them included investigation of associations between classroom learning environment and various outcomes.

Apart from the WIHIC, various other learning instruments have been used in investigating associations between student outcomes and the learning environment. For example, Scott and Fisher (2004) translated an elementary version of the QTI into Standard Malay. This was then administered to 3104 primary school students in Brunei to reveal associations between the science classroom environment and students' enjoyment of the science lessons.

Fraser and Lee (2009) translated the SLEI into the Korean language and used it with 439 students (99 science-independent stream students, 195 science-oriented stream students and 145 humanities stream students) in order to investigate the learning environment of senior high school science laboratory classrooms in Korea. Associations were found between various measures of students' attitudes to science and their perceptions of the learning environment (especially in the areas of Student Cohesiveness, Integration and Rule Clarity).

Because my study was carried out in Singapore, the next few examples focus on findings of associations between student outcomes and the learning environment in the Singapore context. Goh and Fraser (1998) undertook a study in Singapore into associations between two aspects of the classroom learning environment (interpersonal teacher behaviour and classroom climate) and affective and cognitive outcomes among primary mathematics students. Data were collected from 1512 boys and girls from government primary schools. Better achievement and student attitudes were found in classes that were perceived to have more teacher leadership, helping/friendly and

understanding behaviours and less uncertain behaviour and in classes that were perceived to have more cohesion and less friction.

Quek, Wong and Fraser (2005) investigated associations between teacher–student interactions and students' attitudes towards chemistry among 497 Singaporean tenth grade students from three independent schools. They reported associations between the interpersonal behaviour of chemistry teachers and students' enjoyment of their chemistry lessons.

In yet another Singaporean study, Chionh and Fraser (2009) administered the WIHIC to 2310 grade 10 students (aged 15 years) in 75 geography and mathematics classes in 38 schools to investigate associations between classroom environment and several student outcomes. Their study revealed positive associations between better examination scores in classrooms that were perceived to have more student cohesiveness, while self-esteem attitudes were more positive in classrooms perceived to be more task-oriented and to have more teacher support and equity. Differences between the classroom environments of geography and mathematics classes were small relative to the large differences between students' actual and preferred classroom environments.

The Test of Science Related Attitudes (TOSRA) has gained popularity in research into associations between the learning environment and students' attitudes. Section 2.5.1 provides more details about this instrument while the next paragraphs review studies that have used the TOSRA to reveal the existence of attitude–environment associations.

In Singapore, Wong and Fraser (1996) used a modified form of the TOSRA, re-naming it the Questionnaire on Chemistry-related Attitudes (QOCRA), to assess students' attitudes to chemistry. The QOCRA was administered to 1592 final-year secondary school chemistry students in 56 classes in 28 randomly-selected coeducational government schools in Singapore. Findings revealed significant associations between the nature of the chemistry laboratory classroom environment and students' attitudinal outcomes, with

Rule Clarity and Integration being the strongest and most consistent predictors of the attitudinal outcomes and Open-endedness being linked to less favourable science-related attitudes.

In Korea, Kim, Fisher and Fraser (1999) used the TOSRA with 1083 students and 24 science teachers in 12 different schools to investigate the extent to which a new general science curriculum (which incorporated a constructivist view) influenced the classroom learning environment (using the scales from CLES). One class of grade 10 students and one class of grade 11 students were sampled at each school. In this study, students' perceptions showed a statistically significant relationship with their attitudes for the scales of Personal Relevance, Shared Control and Student Negotiation for grade 11.

In Australia, Henderson, Fisher and Fraser (2000) used the SLEI, the QTI and two scales of TOSRA with 489 senior secondary students in 28 classes to investigate biology laboratory classrooms and attitudes towards science. Associations with the learning environment were strongest with attitudes, rather than with either cognitive achievement or practical performance.

In New York, Wolf and Fraser (2008) used the WIHIC and a single TOSRA scale with 1434 students in 71 classes to compare inquiry and non-inquiry laboratory teaching in terms of students' perceptions of the classroom learning environment, attitudes towards science, and achievement among middle-school physical science students. The study also revealed strong and consistent associations between student attitudes and learning environment scales, but associations between achievement and learning outcomes were relatively weaker.

In a more recent study, Fraser, Aldridge and Adolphe (2010) reported a cross-national study of learning environments and attitudes to science using the WIHIC and TOSRA. The study was undertaken with 1161 students (594 from Indonesia and 567 from Australia). Once again, the results attested to the internal consistency reliability and empirical independence of the WIHIC and TOSRA scales for both the Indonesian and English versions. The study

also revealed statistically-significant associations between attitudes and most learning environment scales except for Attitude to Scientific Inquiry and Equity for the Australian sample and between Career Interest in Science and Student Cohesiveness for both the Indonesian and Australian samples.

Peer and Fraser (in press) also incorporated scales from the WIHIC, CLES and TOSRA in the first study of science classrooms in Singapore primary schools involving 1081 students in 55 classes. Factor and reliability analyses provided strong support for the scales. Attitudes were statistically significantly associated with scales from the WIHIC (Involvement, Teacher Support, Investigation, Task Orientation and Cooperation) and the CLES (Personal Relevance, Understanding and Student Negotiation). The results suggested that more positive student attitudes were associated with more emphasis on the learning environment dimensions emphasised in this study.

2.4.5.2 Associations with Self-Efficacy

Recent studies of associations between the learning environment and self-efficacy have also emerged. Similar to the TOSRA, efficacy scales have been developed and used in such studies. An example is the Morgan-Jinks Student-Efficacy Scale (MJSES). Although using the MJSES in learning environment research is relatively new, a few studies have successfully incorporated some or all of its scales in studies of the relationship between the learning environment and students' self-efficacy. This subsection reviews studies using the MJSES for this purpose. More details of the MJSES are provided in Section 2.5.2.

Dorman and Fraser (2008) incorporated the MJSES in part in a study of classroom environment antecedent variables and student affective outcomes (attitude to subject, attitude to computer use and academic efficacy) in Australian high schools. The MJSES was administered in conjunction with the TROFLEI to 4146 high school students. In this study, it was found that all classroom environment dimensions had positive associations with academic efficacy. In particular, academic efficacy had a mediating effect on attitude to

subject. For example, increased levels of involvement were positively related to academic efficacy, which itself was positively related to academic efficacy.

In a more recent study, Gupta and Fisher (2012) used the MJSES with 705 students from 15 science classes from grades 6–11 (around 11–17 years) in India. Their study revealed positive associations between the learning environment (TROFLEI scales) and three student outcomes – attitudes towards science, academic efficacy and achievement.

Afari, Aldridge, Fraser and Khine (2013) incorporated the MJSES in their evaluation of the introduction of games into college-level mathematics classes in the United Arab Emirates in terms of improving students' perceptions of the learning environment and their attitudes towards mathematics. Their study not only supported the factorial validity and internal consistency reliability of the MJSES when used in the context of the study, but the multiple correlation for academic efficacy and the set of the learning environment scales (from WIHIC) was statistically significant.

2.5 Attitudes and Efficacy

The objectives of this study included investigating sex and ethnic differences in attitudes/efficacy, as well as associations between classroom environment and students' attitudes and efficacy. Hence, this section is devoted to reviewing literature about students' attitudes and efficacy and their assessment.

2.5.1 Attitudes

Attitude is a variable that is strongly linked with learning environments. However, the definition of attitudes has been elusive because of its complexity. Peterson and Carlson (1979) acutely pointed out that the use of this term has been loose and often went without clarification. Krathwohl, Bloom and Masia (1964) made some headway in resolving this by developing a taxonomy which placed various affective behaviours along a

hierarchical continuum. This helped to clarify some terms that were used to describe affective behaviours. Five major levels of internalisation were identified in this affective domain: receiving or attending, responding, valuing, organisation, and characterisation by a value or value complex. This was further developed by Klopfer (1971, 1976) into a four-category structure for the affective domain in science education: events in the natural world (awareness and an emotive response to experiences); activities (students' participation in activities related to science, informally and formally); science (the nature of science as a means of knowing the world); and inquiry (scientific inquiry processes).

Reviews of literature on the measurement of attitudes (especially in science) span over four decades (Kerr & Murphy, 2012). Laforgia (1988) reports that research into students' attitudes towards a subject has involved a range of techniques – interviews, open-ended questions, projective techniques, closed-item questionnaires (using Likert scales) and preference rankings. However, as noted by Osborne et al. (2003), it is also this diversity in the methods used in attitudes studies that has led to the recognition of difficulties in measuring attitudes towards science.

Gardner (1975) early on made the distinction between two categories related to attitudes – attitudes towards science and scientific attitudes. His definition of the former constitutes a learned disposition to evaluate objects, people, actions, situations or propositions in certain ways. This disposition refers to the way in which students regard science (i.e. interesting, boring, dull or exciting). Scientific attitudes, however, are defined by Gardner (1975) as desirable attributes of scientists in professional work and could be categorised as interests, adjustments, appreciations and values.

Ramsden (1998) carried on this discussion, raising issues to do with the complexity and lack of clarity over the definition of key terms, which have implications for research instruments, designs and methods. He supports Gardner's (1975) distinction between attitudes to science and scientific attitudes, reiterating that one of the factors that distinguishes attitudes to

science is that there is always an object to which a person responds. This is different from scientific attitudes which he considers as styles of thinking.

Blalock et al. (2008) comprehensively reviewed science attitude instruments and found that most were lacking in their psychometric properties. He recommended that instruments already in existence should be used in replication and extension studies and, more importantly, reliability and validity evidence should be collected and reported. My study incorporated scales to measure attitudes and therefore involved the validation of these scales.

In many of the past learning environment studies that investigated associations with attitudes, the Test of Science Related Attitudes (TOSRA) was used. TOSRA was developed by Fraser (1978, 1981) to measure students' attitudes towards their science classes. This instrument is based on Klopfer's (1976) taxonomy of the affective domain with regard to science education. Table 2.4 gives an overview of the scales and a sample item for each scale. Each scale consists of 10 items with a corresponding five-point Likert response scale ranging from Agree to Strongly Disagree.

TOSRA has been modified and used for other subjects. For example, Walker (2006) undertook a study to develop and validate the Test of Geography-Related Attitudes (ToGRA), an instrument modelled after the TOSRA, for use in the geography classroom. When he used it with 388 grade 9 students from 17 geography classes in San Antonio, Texas, the results led to the first validated affective-trait measurement instrument available to secondary-level researchers and practitioners in geography education.

Ogbuehi and Fraser (2006) modified the TOSRA to suit mathematics classes and renamed it the Test of Mathematics Related Attitudes (TOMRA). They used this instrument with 661 middle-school students from 22 classrooms in California as part of their investigation of the effectiveness of using innovative teaching strategies for enhancing the classroom environment and students' attitudes and conceptual development. Data analyses supported the factor structure, internal consistency reliability, discriminant validity and the ability to

distinguish between difference classes for the TOSRA in the context of the study. Key findings included associations between perceptions of classroom learning environment and students' attitudes to mathematics and conceptual development.

Table 2.4
Klopfer's (1971) Classification and Sample Item for Each TOSRA Scale

Scale	Klopfer (1971) Classification	Sample Item
Social Implications of Science	Manifestation of favourable attitudes towards science and scientists	Money spent on science is worth spending. (+)
Normality of Scientists	Acceptance of scientific inquiry as a way of thought	Scientists usually like to go to their laboratories when they have a day off. (-)
Attitude to Scientific Inquiry	Acceptance of scientific attitudes as a way of thought	I would prefer to find out why something happens by doing an experiment than by being told. (+)
Adoption of Scientific Attitudes	Adoption of 'scientific attitudes'	I am curious about the world in which we live in. (+)
Enjoyment of Science Lessons	Enjoyment of science learning experiences	I dislike science lessons. (+)
Leisure Interest in Science	Development of interest in science and science related activities	I would like to belong to a science club. (+)
Career Interest in Science	Development of interest in pursuing a career in science	I would dislike being a scientist after I leave school. (-)

* Source: Fraser (1981)

Items designated (+) are scored 1, 2, 3, 4, 5, respectively, for the responses Strongly Disagree, Disagree, Not Sure, Agree and Strongly Agree. Items designated (-) are scored in the reverse manner. Missing or invalid responses are scored 3.

Tulloch (2011) modified the TOSRA for use in an English classroom context and used it with 544 students in 29 tertiary classes in the US to investigate the effects of classroom environment on student attitudes. Positive and statistically significant bivariate and multivariate associations were found between students' enjoyment of classes and their perceptions of classroom learning environment.

Adamski, Fraser and Peiro (2013) modified the TOSRA for Spanish language classes, resulting in the Test of Spanish-Related Attitudes (TOSRA-L1), and used it as part of their study of relationships between students' perceptions of

parental involvement in schooling, their Spanish classroom environment and student outcomes (attitudes towards Spanish and Spanish achievement). It was administered to 223 grades 4–6 Spanish-speaking students in nine Spanish classes in one elementary school in South Florida. Statistical analysis supported the factor structure and internal consistency reliability of the modified TOSRA. Results showed strong evidence of associations between learning environment perceptions (scales of the WIHIC) and students' attitudes towards Spanish.

Liu and Fraser (2013) developed a learning environment instrument based on the WIHIC and the Enjoyment scale from TOSRA and modified it to suit an English classroom context. The new instrument, named the English Classroom Environment Inventory (ECLEI), was administered to 1235 high school students in English classrooms in China. The results of the study supported the ECLEI's factorial validity and reliability for assessing students' perceptions of their English classrooms in high schools in Mainland China.

The validation and successful use of the TOSRA have been reported in several studies in addition to those discussed above. In Brunei Darussalam, Riah and Fraser (1998) assessed students' attitudes using one scale of the TOSRA with a sample of 644 chemistry students from 35 classes in 23 government secondary schools. Statistical analyses of the data supported the validity and reliability of the TOSRA for use within that context. Wong and Fraser (1996) modified the TOSRA and used it with a sample of 1592 final-year (or tenth grade) secondary school chemistry students in 56 classes from 28 randomly-selected coeducational government schools in Singapore. Statistical analyses of the data supported the validity and reliability of this modified instrument. This modified instrument was again used in another study with a sample of 497 tenth grade students from three independent schools in Singapore and was again found to be valid and reliable (Quek, Wong & Fraser, 2005).

Because TOSRA has been carefully developed and found to be highly reliable as a result of extensive field testing, I decided to select and modify

one TOSRA scale for my study as it allowed me to investigate students' attitudes to English.

2.5.2 Self-Efficacy

Another aspect that was investigated in my study was self-efficacy. According to Bandura (1986), self-efficacy beliefs focus on what one can do with one's skills rather than one's skills per se. It refers to the confidence level of one's ability. However, high self-efficacy in one setting does not translate into high self-efficacy in another as it tends towards a goal-specific construct which varies according to settings (Bandura, 1982, 1989; Pintrich & Schunk, 1995).

Bandura, perhaps one of the more notable self-efficacy theorists, purports that self-efficacy influences several aspects of behaviour that are important to learning, including the choice of activities that a student makes, the effort put forth and persistence in accomplishing a task (Bandura, 1982, 1989; Schunk 1989; Zimmerman, Bandura, & Martinez-Pons, 1992).

Fraser and Fisher (1994) made the claim that student perceptions account for appreciable amounts of variance in learning outcomes, with children's academic self-efficacy supporting the link between self-efficacy and academic performance. A few studies support this. For example, Schunk's (1982) study revealed that perceptions of efficacy accounted for a significant increment in the explained proportion of variability in posttest skill. Collins (1982), Bouffard-Bouchard (1990) and Bouffard-Bouchard et al. (1991) also demonstrated the independent contribution of self-efficacy to learning outcomes.

Pajares (1996) reported that increased self-efficacy often is associated with one's willingness to engage and persist in challenging tasks. Reviews of research also corroborate the notion that higher self-efficacy leads to an increase in the quality and quantity of information processed and that high-efficacy students are likely to use a wider spread of strategies more flexibly

and process information at a deeper level (Pajares, 1996; Schunk, 1989). Students' self-efficacy beliefs also seem to be significantly related to their academic performance (Lane & Lane, 2001).

Bandura (1989) proposed that self-efficacy beliefs are not just inert predictors of future behaviour, but that people with a higher level of it are more driven to make things happen. Jinks and Morgan's (1999) study seems to support this. They reported relationships between elementary students' perceptions of self-efficacy and self-reported grades, with these relationships being constant across urban, suburban and rural school environments.

In more recent years, Hsieh, Cho, Liu and Scallert (2008) undertook a study in the USA to examine changes in 549 middle-school students' goal orientation, self-efficacy and science knowledge in a science/technology-rich learning environment. They found that performance-avoidance goals moderated the relation between self-efficacy and science achievement; that is, self-efficacy has positive influences on achievement when students are not performance-avoidance oriented.

In a more recent study, Afari, Ward and Khine (2012) investigated relationships between global self-esteem, academic efficacy and academic performance among a sample of 255 college students in the United Arab Emirates. Results indicated significant relationships between global self-esteem and academic self-efficacy. Academic achievement was also associated with having high academic self-efficacy.

Several studies of associations between the learning environment and self-efficacy have also emerged. Perhaps a more popular instrument used for assessing self-efficacy in learning environment research is the Morgan-Jinks Student Efficacy Scale (MJSES; Jinks & Morgan, 1999). This is also the instrument that was of particular interest to my study. Jinks and Morgan (1999) developed the MJSES to assess students' self-efficacy beliefs and to investigate their association with the learning environment. The MJSES was meant to be an extensive inventory that makes use of self-report grades as a

dependent variable. The scale has undergone extensive development to ensure validity and reliability using DeVellis' (1991) model (Jinks & Morgan, 1999). The original version of the scale consisted of 53 items that were generated by Jinks and Morgan (1999) and subjected to content validity evaluation by three separate panels consisting of five university-level teacher educators, four middle-school teachers and 15 public school students representing grades 4–8. This first version comprised four subscales – Talent, Effort, Task Difficulty, and Context. All items are scored on a four-interval response scale: Really Agree, Kind of Agree, Kind of Disagree and Really Disagree. Response choices are meant to mimic children's language patterns such as 'not sure', 'maybe', 'pretty sure' and 'real sure' (Schunk, 1981), while remaining analogous with adults' definitions as reflected in the more traditional language. A typical item from this scale is: "I am good at this subject."

The MJSES was field-tested with three schools representative from three different demographic settings – urban, suburban and rural. The field sites provided 900 usable returns and resulted eventually in a 30-item scale. Statistical analysis also revealed that the overall scale and the various subscales moderately and positively correlated with self-reported grades, which also means that those who expressed higher self-efficacy beliefs also tended to report higher grades.

Because past research supports associations between the learning environment and attitudes and self-efficacy in various countries, I decided to include attitudes and self-efficacy in my learning environment study in Singapore. Hence, I incorporated an attitude scale from the TOSRA and the Self-Efficacy scale from the MJSES in my study. Table 2.5 provides a scale description and a sample item for the attitude scale and the efficacy scale used in my study.

Table 2.5
Scale Description and Sample Item for Each Modified Attitude and Self-efficacy Scale

Scale	Description	Sample item
	The extent to which …	
Attitude to EL	Students enjoy their EL lessons.	I look forward to lessons in EL.
Academic Efficacy	Students have confidence in their academic competence.	I find it easy to get good grades in EL.

*All items used the response alternatives of Almost Never, Seldom, Sometimes, Often and Almost Always.
Adapted from Afari, Aldridge, Fraser, & Khine (2013)

2.6 Chapter Summary

This chapter reviewed literature pertaining to the field of learning environment that is relevant to the current study. Section 2.2 provided an overview of this field, covering it historical background and acknowledging the pioneers of this field – Lewin and Murray in the 1930s and Walberg and Moos in the 1960s.

Sections 2.3 and 2.4 reviewed instruments and their development. Historically-significant instruments that were discussed were the Learning Environment Inventory (LEI), Classroom Environment Scale (CES), Individualised Classroom Environment Questionnaire (ICEQ) and College and University Classroom Environment Inventory (CUCEI). The review moved on to various widely-used instruments before ending with the main instrument which I selected for my study – What Is Happening In this Class? (WIHIC). As the WIHIC was of particular interest to this study, I reviewed its development and its validity and reliability in various past studies in various countries and in various languages. It is especially important to note that this instrument has been used successfully in several prior Asian studies, because the current study also involved an Asian context.

Section 2.4 also included discussion of some determinants of the classroom environment, especially sex differences and ethnic differences as these constructs were pertinent to this study. In the case of ethnic differences, a workable definition gathered from previous research was also provided to establish a general understanding of this complex construct. Literature in these areas was also synthesised and reviewed. Instruments used successfully in past studies to measure these elements were also highlighted.

In particular, the WIHIC was singled out as being widely used and well supported by past studies. This provided a basis for selecting the WIHIC for the current study and a frame in which to situate the context of the study.

As this study also investigated associations between the learning environment and student attitudes and efficacy, Section 2.4 also reviewed past studies of outcome-environment associations, especially those involving student attitudes and efficacy. Instruments that were common to such studies became the thread connecting all of these studies.

Section 2.5 reviewed literature on student attitudes and self-efficacy. It reiterated issues that arose because of the complexities of these two elusive constructs and attempted to establish workable definitions for both student attitudes and efficacy. The TOSRA and the MJSES were highlighted as instruments that were well supported by past studies. A workable definition of self-efficacy has been provided by Bandura (1986).

Section 2.6 summarises and concludes this chapter. Based on this, the next chapter focuses on the methodology of the study, detailing its design, sample, instruments and methods of data analysis.

Chapter 3

METHODOLOGY

3.1 Introduction

In this chapter, the research design and the methods used in my study are detailed. This includes a description of the sample and procedures for gathering and analyzing the data. The research questions are recapitulated, allowing easy clarification of the alignment between the procedures and the objectives of the research.

This chapter is organised in the following manner:

3.2 Specific Research Questions

As discussed in the previous chapter, the What Is Happening In this Class? (WIHIC) has been used successfully in various countries and in various languages. My research used the WIHIC with primary school children in an Asian country and in English Language classrooms. Therefore the first research question was:

Research Question 1a
Is the WIHIC valid and reliable when used in primary English Language classrooms in Singapore?

The Test of Science Related Attitudes (TOSRA) and the Morgan-Jinks Student Efficacy Scale (MJSES), which also were used in my study, have been validated in past studies (Section 2.6). The logical question that arose for this study is:

Research Question 1b
Is an attitude scale based on the TOSRA and a self-efficacy scale based on the MJSES valid and reliable when used in primary English Language classrooms in Singapore?

As reviewed in Chapter 2, past research has identified determinants of classroom environments. This study specifically focused on two aspects – sex and ethnic differences in students' perceptions of the learning environment and their attitudes and self-efficacy. This gave rise to a further research question:

Research Question 2
Are there differences in students' perceptions of the learning environment and attitudes in primary English Language classrooms between:

a. male and female students and
b. Chinese and Malay students?

Chapter 2 also reviewed previous research regarding associations between student attitudes and the learning environment. To determine whether there were such associations for my sample, the third research question was:

Research Question 3
Are there associations between students' attitudes and the learning environment of primary English Language classrooms?

3.3 Background and Selection of the Research Sample

This research was conducted towards the end of 2009. In Singapore, primary education is compulsory and there are around 300 schools for primary school students. The majority, if not all, of these schools are fully government-run and co-educational. There are only a few mission schools left and these are single-sex. Singapore prides itself as a multi-racial society and, as such, Singaporean schools advocate having a mix of the various races, namely, Chinese, Malays, Indians and Others (e.g. Eurasians). The first two groups are the majority races in Singapore (with Chinese being the dominant group). The four schools that I selected were largely representative of this profile. Eventually, all four schools participated in this research, resulting in the involvement of 441 primary six students from 22 classes (averaging 35–40 students each, which is a typical class size for Singaporean upper primary schools). The results generated from this study, therefore, potentially could be extended to most schools in Singapore considering the profile used in this study.

These schools are fully run by the government and all of their full-time teachers received their teacher education in the National Institute of Education. My research was conducted at a time when all schools underwent the SEED (Strategies for Effective Engagement and Development of pupils) approach in the lower primary) and when the slogan Teach Less, Learn More (refer to Chapter 1) encouraged educators to re-examine the fundamentals of teaching and learning. This called for a new paradigm shift in the classroom, with the English Language classroom being no exception.

In this study, I opted to use students rather than teachers as the data source. Literature reviews suggest that students' perceptions usually vary from their teachers' perceptions of the learning environment and that students' perceptions tend to portray a more accurate interpretation of the classroom dynamics (Fraser, 1998; Levy, Wubbels & Brekelmans, 1992). Literature reviews also support students' perceptions of teacher communication style as

being better predictors of student outcomes than teachers' perceptions (Fisher, Fraser & Wubbels, 1993; Levy, Wubbels & Brekelmans, 1992).

Students selected for this study were in their final year of primary school education (Primary 6) and they were about 11–12 years of age. This target group suited the study for two reasons. Firstly, these students would have achieved a certain level of maturity and would have a credible amount of primary school experience. Secondly, students came from mainly four 'neighbourhood' (localised government-run) schools which share a similar profile of students with average linguistic ability.

To address my second research question regarding sex and ethnic differences and the third research question regarding associations in perceptions and attitudes in the learning environment, I analysed data from 202 male students and 232 female students and then from 279 Chinese students and 89 Malay students. This disproportionate number of students in the two ethnic groups (Chinese and Malay) is discussed later in Sections 4.6 and 5.5.

3.4 Selection of Instruments

Research into learning environments started over 40 years ago. As discussed in the previous chapter, there is a range of instruments that have been developed to measure various aspects of the classroom. To fulfil the objectives of this study, it seemed apt to modify and adapt the What Is Happening In this Class? (WIHIC) and to use it to investigate differences in student perceptions of Singaporean primary English Language classrooms.

A modified scale from the Test of Science Related Attitudes (TOSRA) was used to assess attitudes and another modified scale from the Morgan-Jinks Student Efficacy Scale (MJSES) was used to assess efficacy in the English Language. These two modified scales also allowed investigation of associations between the learning environment and student satisfaction.

3.4.1 What Is Happening In this Class?

In Chapter 2, a literature review of studies that used the WIHIC was presented in Section 2.3. This touched on the development of the instrument and its successful use in various studies. In particular, this instrument has been used in various countries and in various languages, including Asia. Table 2.3 (in Chapter 2) captured the wide and varied use of the instrument. This table provides details of each study involving the WIHIC, including the country and language involved and the size of and nature of the sample. Each of these studies also provided strong evidence to support the factorial validity and internal consistency reliability of the WIHIC. The majority of these studies were also able to confirm the WIHIC's ability to differentiate between the perceptions of students in different classrooms (Table 2.3).

The WIHIC incorporates contemporary educational aspects (such as equity and constructivism) in the measurement of the learning environment. It combines existing scales from modified questionnaires. Refinements to this instrument saw the final form containing 56 items or seven eight-item scales – Student Cohesiveness, Teacher Support, Involvement, Investigation, Task Orientation, Cooperation and Equity. It has a five-point frequency response scale ranging from Almost Never to Very Often.

The validity and reliability of this instrument has been demonstrated in many studies: in Australia and Taiwan with 1081 Australian and 1879 Taiwanese junior high science students in 50 classes (Aldridge & Fraser, 2000; Aldridge, Fraser & Huang, 1999); in Australia, UK and Canada with 3980 high school students (Dorman, 2003); in Australia and Indonesia with 567 Australian and 594 Indonesian students in 18 secondary science classes (Fraser, Aldridge & Adolphe, 2010); in Australia and Canada with 1404 students in 81 networked classes (Zandvliet & Fraser, 2004, 2005); in Singapore with 2310 grade 10 geography and mathematics students (Chionh & Fraser, 2009) and with 250 working adults attending computer education courses (Khoo & Fraser, 2008); in India with 1021 science students in 31 classes (Koul & Fisher, 2005); in Australia with 978 secondary school students (Dorman, 2008); in South

Africa with 1077 grade 4–7 students (Aldridge, Fraser & Ntuli, 2009); in Korea with 543 grade 8 science students in 12 schools (Kim, Fisher & Fraser, 2000); in Indonesia with 1400 lower-secondary science students in 16 schools (Wahyudi & Treagust, 2004); in the United Arab Emirates (UAE) with 763 college students in 82 classes (MacLeod & Fraser, 2010); in California, USA, with 665 middle-school science students in 11 schools (den brok et al., 2006), with 525 female university science students in 27 classes (Martin-Dunlop & Fraser, 2008) and with 661 middle-school mathematics students (Ogbuehi & Fraser, 2007); in New York, USA, with 1434 middle-school science students in 71 classes (Wolf & Fraser, 2008); in Florida, USA, with 573 grade 3–5 students (Pickett & Fraser, 2009) and with 120 parents and 520 grade 4 and 5 students (Allen & Fraser, 2007).

The WIHIC seemed suited for this study. However, to cater for the purposes of my study, which was undertaken in English Language classrooms, one scale (Investigation) was excluded from the questionnaire as it did not suit the teaching of this subject in Singapore. Aside from this, the WIHIC was selected for a few reasons. Firstly, WIHIC scales (with the exception of Investigation) were relevant and important for English lessons in Singapore. With slight modification, the scales were able to assess students' perceptions in areas relevant to the new initiatives rolled out by the Ministry of Education (discussed in Chapter 1). The WIHIC scales of Student Cohesiveness, Teacher Support, Involvement, Task Orientation, Cooperation and Equity are important for the English Language classroom. Secondly, the WIHIC has proven to be a valid and reliable tool in much past research in various countries reviewed earlier in this section and summarised in Table 2.3 of Chapter 2. Thirdly, previous research also suggests that students are likely to be comfortable with WIHIC items as they do not directly assess student performance, personality or character. Hence, students are likely to indicate their honest responses and this helps to give a clearer picture of their learning environment. Furthermore, the WIHIC is economical and easily administered. A copy of the WIHIC can be found in Appendix C.

3.4.2 Test of Science-Related Attitudes

Chapter 2 included a review of literature relevant to this instrument (in Section 2.5), including the conception and development of TOSRA, as well as its use and validation in previous research. To assess students' attitudes to the English Language, I opted to use one of the scales in TOSRA – Enjoyment of Science Lessons. However, because the slant of my research was towards the English Language, this scale was modified to Attitude to English Language Lessons. Past research has supported the validity and the reliability of the original single TOSRA scale. Hence, I included it in my study.

As discussed in Chapter 2, the TOSRA was based on Klopfer's (1971) classification of the affective domain. TOSRA has seven scales to match this classification – Social Implications of Science, Normality of Scientists, Attitude to Scientific Inquiry, Adoption of Scientific Attitudes, Enjoyment of Science Lessons, Leisure Interest in Science and Career Interest in Science – each scale consisting of 10 items. The response format of this instrument makes use of a Likert-type rating scale which offers a range of five choices – Strongly Agree (SA), Agree (A), Not Sure (N), Disagree (D) and Strongly Disagree (SD).

Fraser (1981) found that there were three TOSRA scales which measure overlapping dimensions – Leisure Interest in Science, Career Interest in Science, and Enjoyment of Science Lessons. This resulted in only one of these scales being used to measure attitude in some later studies (Aldridge, Fraser, Taylor & Chen, 2000; Fraser & Lee, 2009).

As discussed in Chapter 2, the TOSRA has proven to be valid and reliable in several studies in the past (Fraser, Aldridge & Adolphe, 2010; Henderson, Fisher & Fraser, 2000; Wolf & Fraser, 2008; Wong & Fraser, 1996; Quek, Wong & Fraser, 2005). In addition, Chapter 2 also highlighted a few studies that have made modifications to the TOSRA to cater for other subjects. These studies have also provided validity support for modified versions – the Test of Geography-Related Attitudes (ToGRA) by Walker (2006), the Test of

Mathematics Related Attitudes (TOMRA) by Ogbuehi and Fraser (2007) and the Test of Spanish-Related Attitudes (TOSRA-L1) by Adamski, Fraser and Peiro (2013).

In the current study, the items in the Enjoyment of Science Lessons scale and the name of the scale were modified to reflect the intention of the instrument more accurately. This scale was renamed simply Attitude to the English Language. In order to align with the rest of the instrument (which incorporated the WIHIC and one scale from MJSES), the number of items for this scale was cut down from ten to eight items. Another modification that had to be made was changing the response alternatives to match the frequency responses in the rest of the instrument. This necessitated slight re-wording of some items. Table 3.1 shows the modification of items set against the original TOSRA items.

All of the items in the questionnaire were also presented in the positive so as to avoid or minimise the probability of misinterpretation. Cheung (2009) advocates this and noted that researchers (such as Miller & Cleary, 1993; Pilotte & Gable, 1990; Schmitt & Stults, 1985) have found that items worded negatively (or presented as reversals of items presented positively) can load on separate factors, resulting in a measurement artefact. Moreover, because my target group involved young participants, it seemed all the more crucial to lessen confusion for them by avoiding negative wording of items. A copy of the TOSRA can be found in Appendix D.

3.4.3 Morgan-Jinks Student Efficacy Scale

As mentioned in Chapter 2, attitudes and self-efficacy are rather elusive constructs, yet they seem to have important parts to play in learning. The current study included self-efficacy because of its importance and its link with the learning environment in past research (Bandura, 1982, 1989; Pajares, 1996; Schunk, 1989; Zimmerman, Bandura & Martinez-Pons, 1992). To do this, I chose part of the Morgan-Jinks Student Efficacy Scale (MJSES; Jinks

& Morgan, 1999) and investigated its association with the learning environment.

The MJSES was designed to obtain information about student efficacy beliefs that might relate to school success (Jinks & Morgan, 1999). The scale went through extensive development.

TABLE 3.1
Comparison of the Wording of the Original and Modified Versions of TOSRA's Enjoyment of Lessons Scale

Enjoyment of Science Lessons		Attitude to EL	
Polarity	Item	Polarity	Item
+	Science Lessons are fun.	+	Lessons in EL are fun.
-	I dislike science lessons.	+	I like lessons in EL.
+	Schools should have more science lessons each week.		
-	Science lessons bore me.	+	Lessons in EL excite me.
+	Science is one of the most interesting school subjects.	+	EL is one of the most interesting school subjects.
-	Science lessons are a waste of time.	+	Lessons in EL are meaningful to me.
+	I really enjoy going to science lessons.	+	I enjoy lessons in EL.
-	The material covered in science lessons is uninteresting.	+	These lessons make me interested in EL.
+	I look forward to science lessons.	+	I look forward to lessons in EL.
-	I would enjoy school more if there were no science lessons.		

Items designated (+) in the original scale are scored 1, 2, 3, 4, 5, respectively, for the responses Strongly Disagree, Disagree, Not Sure, Agree and Strongly Agree. Items designated (-) are scored in the reverse manner. Missing or invalid responses are scored 3. In the modified version, items are also scored 1, 2, 3, 4, 5. However the responses were modified: Almost Never, Seldom, Sometimes, Often, Almost Always.
Source: Fraser (1981)

Validity and reliability were ensured using DeVellis' (1991) recommended procedures. Its original version consisted of four subscales – talent, effort, task difficulty, and context – and consisted of 53 items. After the MJSES was field-tested, it was found that the items originally in the Task Difficulty scale did not load together with sufficient strength to be considered as a factor. The MJSES was thus revised to three scales (with Task Difficulty excluded) and consisted of 30 items. The response format is a four-interval Likert scale: Really Agree, Kind of Agree, Kind of Disagree and Really Disagree (Jinks & Morgan, 1999). However, my study, the response scale was modified to a five-point frequency scale to align it with the rest of the instrument. Respondents were offered the following choices – Almost Never, Seldom, Sometimes, Often, and Almost Always.

As with the TOSRA, the items in the Self Efficacy scale and the name of the scale were modified to reflect of the intention of the instrument more accurately. This scale was renamed Academic Efficacy in the English Language. In order to align with the rest of the instrument (which incorporated the WIHIC and one scale from TOSRA), the number of items for this scale was kept to eight items. Another modification involved changing the response alternatives to match the rest of the instrument. This necessitated slight re-wording of some items so that all items were kept positive and 'English Language' was specified for all items. Students were asked to respond to items that reflected their perceptions of their ability in the English Language – "I find it easy to get good grades in EL", "I am good at EL" and "My friends ask me for help in EL". These items encompassed both intrapersonal and interpersonal perceptions of the student's competency in English.

The MJSES was first field-tested in three schools and, in all three cases, proved valid and reliable (Jinks & Morgan, 1999). Subsequently, other studies also incorporated the MJSES and their findings supported its validity and reliability (Afari, Aldridge, Fraser & Khine, 2013; Dorman & Fraser, 2009; Gupta & Fisher, 2012). A copy of the MJSES can be found in Appendix E.

3.5 Assembling the Instrument

I decided to assemble various scales of the WIHIC, TOSRA and the MJSES into one questionnaire to facilitate its administration to the students. I opted only to use the relevant scales from the TOSRA and the MJSES rather than the full questionnaires to minimise test fatigue among my young subjects. The result was a 64-item questionnaire with eight scales (eight items per scale) – Student Cohesiveness, Teacher Support, Involvement, Task Orientation, Cooperation and Equity from the WIHIC; Attitude/Enjoyment from the TOSRA; and Academic Efficacy from the MJSES. I also opted to use the same five response alternatives for all the scales in the questionnaire – Almost Never, Seldom, Sometimes, Often, Almost Always – and provided an explanation and an illustration so that survey participants could follow more easily. The survey was organised with the WIHIC items appearing first (Items 1 – 48), followed by the TOSRA items (Items 49 – 56) and then the items from the MJSES (Items 57 – 64). The final questionnaire is presented in Appendix B.

To ensure readability of the survey, the instrument was piloted with a class of students around the same age range. The results were not analysed nor included in this thesis. Students were asked to highlight the words that they were not sure of, in addition to completing the survey. An informal session was held with some student representatives from this group and vocabulary was clarified to see if they understood what was intended by the researcher.

As mentioned, including the various scales from different instruments in a single questionnaire was a deliberate move. Apart from easing administrative burden and test fatigue, this also helped to reduce the amount of time needed for students to complete the items. One important consideration in following this approach was to minimise confusion that could possibly result from having to respond to three different questionnaires. Bearing in mind that these were young participants, it became essential to do so.

3.6 Data Collection

A pilot study was first conducted with a primary five class (aged around 11 years) with the intention of checking the readability and comprehensibility of the instrument. Students were asked to complete the questionnaire and to highlight words or phrases that they did not understand. In addition to this, the pilot study also helped to determine a suitable duration for the actual administration of the survey.

The initial step in the main study was to officially write to the principals of the four primary schools and request permission to administer the survey. Information was also provided regarding the objectives of the research and the purpose and content of the survey. After the principals of the four schools consented to participation in the study, the survey materials were then sent in.

Schools were briefed about the purpose and the administration of the survey. Help was solicited from the teachers whose students were involved. Consent forms were issued to participating teachers and students and, because my participants were young, consent forms were also issued to their parents (see Appendix F). A student was only considered to be a participant after consent forms from the teacher, his/her parent and the student himself/herself were all obtained. Each participant was given a booklet which contained the survey items, as well as directions on how to complete the survey. Generally, the students completed the survey in half an hour.

All surveys were collected and returned to me within two weeks. All in all, 490 students took part in the survey. However, faulty responses surfaced. These included multiple responses or skipped entries. These were discarded, resulting in the sample size going down to 441 participants. Data from the completed questionnaires were entered into a Microsoft Excel spreadsheet. This was then inputted into the Statistical Package for Social Sciences (SPSS) software for further analysis.

3.7 Data Analysis

The data collected from the survey were used to answer my research questions (reiterated in Section 3.2 of this chapter). This section is devoted to describing statistical analysis procedures used to answer these questions. The first research question involved the validity and reliability of the modified learning environment and attitude scales used in a Singaporean setting. Procedures to determine the instrument's validity and reliability are discussed in Section 3.7.1. Data analysis methods for the second research question, which focused on sex and ethnicity as determinants of the learning environment and attitudes towards the English Language, are reported in Section 3.7.2. The final question involving the effects of the learning environment on students' attitudes was analysed, as described in Section 3.7.3, using simple correlations, multiple correlations and standardised regression coefficients.

3.7.1 Validity and Reliability of Instrument

To address my Research Question 1 regarding the validity and reliability of the instrument, several statistical analytical procedures were carried out. First, principal axis factoring followed by varimax rotation and Kaiser normalization was conducted to determine the factorial validity of the 64 items in the 8 WIHIC and attitude scales. This was carried out with the data from 441 primary six students. It was also later used to confirm the a priori structure of the 64-item instrument with eight items within each of the seven scales. In order to improve internal consistency reliability and discriminant validity, the criteria set for the retention of any item were that it had to have factor loadings of at least 0.40 on its own scale and less than 0.40 on all of the other scales. Chapter 4 provides more information on the factor structure of the instrument (refer to Section 4.2).

Cronbach's alpha coefficient (Cronbach, 1951) was used as a measure of the internal consistency reliability of each scale of the research instrument. This step was necessary to check for the extent to which each item in a scale

measures the same construct. For each WIHIC scale, the Enjoyment scale from the TOSRA and the Self-Efficacy scale from the MJSES, reliability analyses were undertaken for two units of analysis (the student and the class). A reporting of the findings can be found in Chapter 4 (refer to Section 4.2).

Discriminant validity analysis was also undertaken for each of the scales in order to establish the extent to which each scale measures a unique dimension that is independent of the other scales in the instrument. The mean correlation of a scale with the other scales was used as a convenient index of discriminant validity. Two units of analysis were used: the student and the class mean. The next chapter provides the findings for this (refer to Section 4.2).

Another aspect that needed to be considered in response to Research Question 1 was each learning environment scale's ability to differentiate between the perceptions of students in different classrooms. To investigate this, analysis of variance (ANOVA) was used to determine the ability of each environment scale to differentiate between the perceptions of students in different classes. The eta^2 value (which represents the ratio of 'between' to 'total' sums of squares), was used to describe the proportion of variance accounted for by class membership. These results are also reported in Chapter 4 (refer to Section 4.2).

3.7.2 Sex and Ethnicity as Determinants of Classroom Environment

Research Question 2 involved differences in students' perceptions of their learning environment, enjoyment and self-efficacy in the English Language according to their sex and ethnicity. To address this, several analyses were conducted.

Multivariate analyses of variance (MANOVA) were first conducted to examine if sex and ethnic differences could be detected in the scores obtained from the whole set of eight learning environment an attitude scales. Wilks' lambda

criterion was used to determine if there were between-group differences for the set of the eight dependent variables as a whole. Because the results yielded statistically significant sex or ethnic differences overall, the univariate ANOVA results were interpreted separately for each of the eight dependent variables.

Cohen (1988) recommends calculating effect sizes to describe the magnitude or educational importance of research findings. The computation of Cohen's *d* involves the difference between the two means divided by the pooled standard deviation. For the *d* statistic, Cohen (1988) considers 0.20 as being small, 0.50 as being medium and 0.80 as being large. Chapter 4 (specifically, Section 4.5 for sex and Section 4.6 for ethnicity) reports these findings.

3.7.3 Associations between Students' Perceptions of the Classroom Environment and Attitudes

The third research question explored associations between students' perceptions of their learning environment and their attitudes. Simple correlations (*r*) were used to indicate the strength of the bivariate association between each WIHIC scale and each attitude scale. Multiple regression analysis was conducted for each attitude measure to provide information about the joint influence of the set of correlated WIHIC scales on either attitude or academic efficacy. The standardised regression coefficient (β) was used to describe the association between an attitude and a particular WIHIC scale when the effect of the other WIHIC scales was kept constant. These findings are reported in greater detail in Chapter 4 (refer to Section 4.7).

3.8 Chapter Summary

This chapter described and discussed the methods used in this study. It discussed the sample, instruments, and analysis procedures used to answer the specific questions raised in this research – validating the research instrument, investigating two determinants (sex and ethnicity) of classroom

environment and attitudes, and investigating associations between students' attitudes and efficacy in the English Language and the classroom environment.

The sample comprised 441 students from 22 classes (in four similar schools). The modified 64-item research instrument contained eight scales – six scales from the WIHIC, the enjoyment scale from TOSRA, and the self-efficacy scale from the MJSES. This was administered to obtain data from these 441 students.

The instrument underwent several procedures to determine validity and reliability. Factor analysis first was used to check the structure. Internal consistency was also determined using the Cronbach's alpha coefficient. Discriminant validity analysis was undertaken using the mean correlation of a scale with the other scales of the instrument. Analysis of variance (ANOVA) was conducted to check the ability of each classroom environment scale to distinguish between students' perceptions in the 22 different classrooms. Eta^2 values were computed to indicate the proportion of variance accounted for by class membership.

To address the second research question regarding two determinants (sex and ethnicity) of the learning environment and attitudes in primary English Language classrooms, multivariate analysis of variance (MANOVA) was undertaken. The eight scales of the instrument were used as dependent variables. Effect sizes were also computed, as recommended by Cohen (1988), to determine the magnitude, or educational importance, of sex and ethnic differences.

Lastly, to answer the third research question regarding associations between students' attitudes and the learning environment, simple correlation and multiple regression analyses were conducted using two units of analysis – the class mean and the student. The Attitude and the Efficacy scales were used as the dependent variable, while the six scales of the WIHIC served as the independent variables. Standardised regression weights were used to

help to identify which classroom environment scales contributed most to student enjoyment and self-efficacy when the remaining environment scales were mutually controlled.

The next chapter provides a detailed report of the findings based on the procedures described in Chapter 3. Results are visually presented in tables and detailed explanations are provided to show how the findings address my research questions.

Chapter 4

RESULTS

4.1 Introduction

This chapter reports results related to my research questions. Firstly, findings are reported for the validity and the reliability of the modified questionnaire which was modelled on six scales of the WIHIC, the 8-item attitude scale of the TOSRA and the 8-item academic efficacy scale of the MJSES. Secondly, findings are reported for differences in students' perceptions of the learning environment and attitudes in primary English Language classrooms between (i) male and female students and (ii) Chinese and Malay students. Thirdly, findings are reported for associations between students' attitudes and the learning environment of primary English Language classrooms.

The results are organized under the following sections:

4.2 Overview of the Research Methods

This study validated a modified learning environment and attitudes questionnaire, investigated sex and ethnic differences, and explored associations between students' attitudes and the learning environment of primary English Language classrooms. The research was carried out with a

sample of 441 students from 22 classes (in four similar schools). The 64-item research instrument was administered to the sample to obtain the data. The specific research questions are as follows:

Research Question 1

Are the following questionnaires valid and reliable when used in primary English Language classrooms in Singapore:

a. *the WIHIC*
b. *an attitude scale based on the TOSRA and a self-efficacy scale based on the MJSES?*

Research Question 2

Are there differences in students' perceptions of the learning environment and attitudes in primary English Language classrooms between:

a. *male and female students and*
b. *Chinese and Malay students?*

Research Question 3

Are there associations between students' attitudes and the learning environment of primary English Language classrooms?

To address the first question, factor analysis was used to check questionnaire structure. Cronbach's alpha coefficient was also used as a measure of scale internal consistency. Discriminant validity analysis was undertaken using the mean correlation of a scale with the other scales of the instrument. ANOVA was employed to check whether the learning environment scales could differentiate between the perceptions of students in different classes.

To address the second research question which had to do with sex and ethnicity as determinants of learning environment and attitudes, multivariate analysis of variance (MANOVA) was undertaken. The eight scales of the instrument were used as dependent variables. To determine the magnitude,

or educational importance, effect sizes were also computed as recommended by Cohen (1988) for sex and ethnic differences.

Finally, for the third research question regarding associations between students' attitudes and the learning environment, simple correlation and multiple regression analyses were conducted using two units of analysis – the class and the student mean. The Enjoyment and the Efficacy scales were used as the dependent variable, while the six scales of the WIHIC were used as the set of independent variables. Standardised regression weights were used to help identify which classroom environment scales contributed most to student enjoyment and self-efficacy when the remaining environment scales were mutually controlled.

4.3 Validity and Reliability of Learning Environment Scales (WIHIC)

One of the aims of this research was to modify and validate a set of learning environment scales based on the WIHIC specifically in primary EL classrooms in Singapore. A sample of 441 students in 22 Singaporean classes responded to six scales (eight items per scale) from the WIHIC (Student Cohesiveness, Teacher Support, Involvement, Task Orientation, Cooperation, Equity). Questionnaires were discussed previously in Chapter 2 (Sections 2.3.10 and 2.4.5) and Chapter 3 (Section 3.4). To check the validity and the reliability of the WIHIC, statistical analyses of the data were undertaken to check its factor structure, internal consistency reliability and ability to differentiate between classes.

Principal axis factoring followed by varimax rotation and Kaiser normalization was first conducted to determine the factorial validity of the WIHIC. The criteria set for the retention of any item was that it had to have factor loadings of at least 0.40 on its own scale and less than 0.40 on all other WIHIC scales. This led to the exclusion of one of the items under Student Cohesiveness – "In this class, I get help from other students" – because it did not meet the criteria set. It was thus rendered faulty and subsequently excluded in order to improve the factorial validity of the instrument. All of the other WIHIC items

were retained as they satisfied the above criteria for retention. All of the original six scales of the WIHIC were retained. Table 4.1 shows in detail the factor loadings obtained for each WIHIC item (with the exception of Item 8). The bottom of Table 4.1 shows that the percentage of variance accounted for was 2.77% (Student Cohesiveness), 3.79% (Teacher Support), 7.74% (Involvement), 3.38% (Task Orientation), 32.91% (Cooperation) and 5.02% (Equity). The total proportion of variance accounted for was 55.61%. The eigenvalues ranged from 1.33 (Student Cohesiveness) to 15.79 (Cooperation). The factor analysis results indicate strong support for the factorial validity of the six-scale modified version of the WIHIC when used with neighbourhood primary schools in Singapore.

To check the internal consistency reliability of WIHIC scales, alpha coefficients (Cronbach, 1951) were used as an index of scale internal consistency. This was done to check the extent to which items in the same scale measure the same dimension, thereby contributing to internal consistency. The reliability of each of the WIHIC scales was estimated using both the individual and the class mean as the units of analysis.

Table 4.2 reports the alpha reliability coefficients for each WIHIC scale. According to the table, alpha coefficients ranged from 0.81 (Student Cohesiveness) to 0.92 (Equity) when the individual student was used as the unit of analysis and from 0.77 (Involvement) to 0.91 (Equity) when the class mean was used as the unit of analysis. These figures are somewhat similar to those found in the research undertaken by Aldridge, Fraser and Huang (1999) which ranged from 0.85 to 0.90 for a sample of 1879 Grade 7 – 9 students from 50 classes in Taiwan.

Discriminant validity analysis was also conducted to provide information about scale independence. This was assessed using each scale's mean correlation with the other scales, using both the individual student and the class mean used as the unit of analysis.

TABLE 4.1
Factor Loadings for Learning Environment Scales

Item	Factor Loadings					
	Student Cohesiveness	Teacher Support	Involvement	Task Orientation	Cooperation	Equity
1	0.58					
2	0.43					
3	0.53					
4	0.67					
5	0.52					
6	0.43					
7	0.54					
9		0.68				
10		0.64				
11		0.67				
12		0.65				
13		0.66				
14		0.59				
15		0.51				
16		0.45				
17			0.53			
18			0.64			
19			0.41			
20			0.64			
21			0.57			
22			0.57			
23			0.40			
24			0.41			
25				0.68		
26				0.62		
27				0.62		
28				0.67		
29				0.62		
30				0.45		
31				0.53		
32				0.66		
33					0.49	
34					0.44	
35					0.60	
36					0.65	
37					0.59	
38					0.69	
39					0.59	
40					0.52	
41						0.51
42						0.65
43						0.67
44						0.70
45						0.65
46						0.65
47						0.58
48						0.49
% Variance	2.77	3.79	7.74	3.38	32.91	5.02
Eigenvalue	1.33	1.81	3.71	1.62	15.79	2.41

N = 441 students in 22 classes.
Factor loadings less than 0.40 have been omitted from the table.
Principal axis factoring with varimax rotation and Kaiser normalization.

TABLE 4.2
Average Item Mean, Average Item Standard Deviation, Internal Consistency Reliability (Cronbach Alpha Coefficient) and Discriminant Validity (Mean Correlation with Other Scales) for Each Learning Environment and Attitude Scale and ANOVA Results for Ability to Differentiate Between Classrooms (ANOVA Results) for Each Learning Environment Scale

Scale	No of Items	Unit of Analysis	Mean	SD	Alpha Reliability	Mean Correlation	Eta^2
Learning Environment							
Student Cohesiveness	7	Individual	4.05	0.59	0.81	0.42	0.07
		Class	4.01	0.18	0.84	0.27	
Teacher Support	8	Individual	3.86	0.76	0.88	0.45	0.07
		Class	3.80	0.25	0.82	0.34	
Involvement	8	Individual	3.54	0.72	0.86	0.51	0.03
		Class	3.56	0.17	0.77	0.34	
Task Orientation	8	Individual	4.23	0.63	0.88	0.46	0.06
		Class	4.22	0.15	0.80	0.36	
Cooperation	8	Individual	4.02	0.67	0.91	0.51	0.03
		Class	3.99	0.11	0.90	0.38	
Equity	8	Individual	3.86	0.79	0.92	0.48	0.07
		Class	3.90	0.26	0.91	0.44	
Attitudes							
Attitude to EL	8	Individual	3.90	0.95	0.95	0.30	
		Class	3.95	0.44	0.97	0.35	
Academic Efficacy	8	Individual	3.13	0.91	0.90	0.30	
		Class	3.10	0.37	0.94	0.35	

N=441 students in 22 classes.

Table 4.2 reports that the mean correlation of one scale of the WIHIC with the other scales ranged from 0.42 (Student Cohesiveness) to 0.51 (Involvement and Cooperation) when the individual student mean was used as the unit of analysis and from 0.27 (Student Cohesiveness) to 0.44 (Equity) when the class mean was used as the unit of analysis. These values are small enough to suggest that raw scores on each scale of the WIHIC has satisfactory discriminant validity and measures distinct but somewhat overlapping components of the primary EL classroom environment. Furthermore, the factor analysis results attest to the independence of factor scores. These results are similar to those reported by Aldridge et al. (1999) in Taiwan for which the reported range was 0.41 to 0.58 when the individual student was used as the unit of analysis with a sample of 1879 Grade 7–9 students from 50 classes.

An analysis of variance (ANOVA) for each of the scales of the WIHIC was used to measure its ability to differentiate between the perceptions of

students in different classrooms. Students within a class should tend to view that classroom learning environment similarly, but perceive different classrooms differently. This characteristic is not relevant for attitude scales. Table 4.2 shows the ANOVA results expressed as eta^2 values, which represent the ratio of 'between' to 'total' sums of square or the proportion of variance accounted for by class membership. The eta^2 statistic ranged from 0.03 to 0.07 for different WIHIC scales. Because eta^2 values were small and not statistically significant in this study, it seems that students' perceptions of these primary EL classes were not too diverse.

In terms of factor structure and reliability of the WIHIC scales, this study replicates previous research: in the USA by Wolf and Fraser (2007) with 1434 science students in 71 classes, Allen and Fraser (2008) with 520 Grade 4 and 5 students aged 9–11 years from 22 classes in 3 schools and 120 of their parents, Ogbuehi and Fraser (2007) with 661 students from 22 classrooms, and Rickards, Bull and Fisher (2001) with 1720 eighth-grade science students from 65 classes in 11 middle schools; in India by Koul and Fisher (2005) with 1021 students in 32 science classes in seven educational private schools; in Canada by Zandvliet and Fraser (2004, 2005) with 1404 computing students in 81 senior high classes; in Indonesia by Margianti, Fraser amd Aldridge (2004) with 2498 computing students in 50 university classes; in Taiwan by Aldridge, Fraser and Huang (1999) with a sample of 1879 Grade 7–9 science students from 50 classes; in Singapore by Chionh and Fraser (2009) with a sample of 2310 Secondary Four (Grade 10) mathematics and geography students in the Express course in 75 classes from 38 schools; in Brunei by Khine and Fisher (2000) with 1188 Form 5 science students in 54 classrooms; in Korea by Kim, Fisher and Fraser (2000) with 543 science students in 12 different schools; in Australia, UK, and Canada by Dorman (2003) and Dorman et al. (2003) with 3980 grade 8, 10, and 12 students; and in Australia by Fraser, Fisher and McRobbie (1996) with 800 secondary school science students in 30 science classes and Rawnsley and Fisher (1997) with a sample of 490 Grade 9 mathematics students in 23 classrooms in 14 schools in Adelaide, South Australia.

4.4 Validity and Reliability of Attitude Scales (TOSRA & MJSES)

The attitude measures used in this study were one scale adapted from TOSRA to measure attitudes to English and a scale from MJSES to measure academic efficacy. As discussed previously in Chapter 2 (Section 2.4.5) and 3 (Section 3.4.2), the TOSRA was designed for science lessons. Based on Klopfer's (1971) classification of the affective domain, there are seven ten-item scales in the TOSRA – Social Implications of Science, Normality of Scientists, Attitude to Scientific Inquiry, Adoption of Scientific Attitudes, Enjoyment of Science Lessons, Leisure Interest in Science and Career Interest in Science. However, Fraser (1981) found that there were three TOSRA scales which measure overlapping dimensions – Leisure Interest in Science, Career Interest in Science, and Enjoyment of Science Lessons. This led to only one scale being used to measure attitudes in some later studies (Aldridge, Fraser, Taylor & Chen, 2000; Fraser & Lee, 2009).

As was mentioned earlier in Section 2.6, the TOSRA had also been modified for use in other subjects. These studies validated the TOSRA in their contexts and for various subjects: for geography, the Test of Geography-Related Attitudes (ToGRA) by Walker (2006); for mathematics, the Test of Mathematics Related Attitudes (TOMRA) by Ogbuehi and Fraser (2006); for Spanish, the Test of Spanish-Related Attitudes (TOSRA-L1) by Adamski, Fraser and Peiro (2013); and for English, the English Classroom Environment Inventory (ECLEI) by Liu and Fraser (2013).

In this current study, the items in the Enjoyment of Science Lessons scale and the name of the scale were modified to reflect more accurately the intention of the instrument. This scale was renamed Enjoyment of English Language Lessons. In order to align with the rest of the instrument (which incorporated the WIHIC and one other scale from MJSES), the number of items for this scale was also cut down from ten to eight items. All the items in the questionnaire were also presented with positive wording in order to avoid or minimise the probability of misinterpretation or confusion.

Chapter 2 (Section 2.4.5.2) and 3 (Section 3.4.3) discussed the MJSES as a measure of student efficacy beliefs that potentially might relate to school success (Jinks & Morgan, 1999). Validity and reliability were maximised using DeVellis' (1991) recommended procedures. For my study, items were modified to reflect English Language as a subject and the original four-interval Likert scale (Really Agree, Kind of Agree, Kind of Disagree, and Really Disagree) was modified to a five-point frequency scale (Almost Never, Seldom, Sometimes, Often, and Almost Always) to align with the response alternatives of the rest of the research instrument.

To check the validity and the reliability of these scales, factor, internal consistency reliability and discriminant validity analyses were undertaken. Principal axis factoring followed by varimax rotation and Kaiser Nominalization were conducted to determine the factorial validity of the attitude questionnaire. The criteria for the retention of any item were that it had to have factor loadings of at least 0.40 on its own scale and less than 0.40 on all of the other scales. All of the items were retained as they satisfied these criteria for retention. Table 4.3 shows in detail the factor loadings for each of the TOSRA (Items 1–8) and MJSES (Items 9–16) items in the questionnaire.

The percentage of variance accounted for was 51.55% (Attitude to English Language) and 17.31% (Academic Efficacy) as shown at the bottom of Table 4.3. The total proportion of variance accounted for was 68.86%. The eigenvalue was 2.77 for Academic Efficacy and 8.49 for Attitude to English Language. The factor analysis indicates strong support for the factorial validity of the adapted versions of the TOSRA and MJSES when used with neighbourhood primary schools in Singapore.

To check the internal consistency reliability of the attitude and efficacy questionnaire, the alpha coefficient (Cronbach, 1951) was used as an index of the extent to which items in the same scale measure the same dimension. The reliability of each of the WIHIC scales was estimated using both the individual and the class mean as the units of analysis.

TABLE 4.3
Factor Loadings for Attitude Scales

Item	Factor Loadings	
	Attitude to English Language	Academic Efficacy
1	0.80	
2	0.86	
3	0.86	
4	0.88	
5	0.76	
6	0.85	
7	0.72	
8	0.82	
9		0.65
10		0.81
11		0.68
12		0.72
13		0.79
14		0.71
15		0.58
16		0.67
% Variance	51.55	17.31
Eigenvalue	8.49	2.77

N = 441 students in 22 classes.
Factor loadings less than 0.40 have been omitted from the table.
Principal axis factoring with varimax rotation and Kaiser normalization.

Table 4.2 reports the alpha reliability coefficient for each attitude scale. According to the table, the alpha coefficient was 0.90 for Academic Efficacy and 0.95 for Attitude to English Language when the individual student was used as the unit of analysis, and was 0.94 for Academic Efficacy and 0.97 for Attitude to English Language when the class mean was used as the unit of analysis. The satisfactory reliability of the TOSRA and MJSES scales, thus, was confirmed.

Discriminant validity analysis was again conducted to provide information about scale independence. The correlation between the two attitude scales was calculated using both the individual student and the class mean as the unit of analysis. Table 4.2 shows that the correlation between Attitude to English and Academic Efficacy was 0.30 when the individual student was used as the unit of analysis and was 0.35 when the class mean was used as the unit of analysis. Again, these values are small enough to suggest that the attitude and efficacy scale have satisfactory discriminant validity and that raw scores on each scale measure distinct but somewhat overlapping

components of the primary EL students' attitudes. The factor analysis results also attest to the independence of factor scores on the two attitude scales.

Overall, the TOSRA and MJSES scales in my study demonstrated sound factorial validity, internal consistency reliability and discriminant validity for two units of analysis (the individual student and class mean). This study also replicates the validity results for these two instruments when used in previous studies. For the TOSRA, these studies include Henderson, Fisher and Fraser (2000) with 489 senior secondary students in 28 classes in Australia, Wolf and Fraser (2008) with 1434 students in 71 classes in the USA and Fraser, Aldridge and Adolphe (2010) with 1161 students in Indonesia and Australia. For the MJSES, these studies include Dorman and Fraser (2008) with 4146 high school students in Australia, Gupta and Fisher (2012) with 705 students in India, and Afari, Aldridge, Fraser and Khine (2013) with 352 college students in United Arab Emirates.

4.5 Sex Differences in Learning Environment Perceptions and Attitudes

The same sample of 441 primary students in 22 classes (202 males and 232 females) was used to investigate my second research question concerning sex differences in students' perceptions of the learning environment and attitudes in primary English Language classrooms. Approximately 45.8% of the students were male and 52.6% of the students were female, with seven students failing to indicate whether they were male or female.

Sex differences in learning environment perceptions and attitudes were examined using MANOVA (multivariate analysis of variance). For the MANOVA, the six WIHIC scales and two attitude scales were used as the dependent variables and sex was the independent variable. Because the multivariate test using Wilks' lambda criterion yielded statistically significant sex differences for the set of dependent variables as a whole, the univariate ANOVA results were interpreted separately for each of the eight dependent variables as shown in Table 4.4.

TABLE 4.4
Average Item Mean, Average Item Standard Deviation and Sex Difference (Effect Size and ANOVA Result) for Each Learning Environment and Attitude Scale

Scale	Average Item Mean		Average Item SD		Difference	
	Male	Female	Male	Female	Effect Size	*F*
Learning Environment						
Student Cohesiveness	4.01	4.11	0.63	0.52	0.17	1.37
Teacher Support	3.81	3.93	0.72	0.77	0.16	1.31
Involvement	3.53	3.56	0.74	0.69	0.04	0.62
Task Orientation	4.13	4.35	0.65	0.53	0.37	1.95**
Cooperation	3.91	4.14	0.66	0.63	0.35	1.89**
Equity	3.84	3.89	0.78	0.81	0.06	0.75
Attitudes						
Attitude to EL	3.84	3.97	0.99	0.91	0.13	1.20
Academic Efficacy	3.11	3.17	0.87	0.93	0.07	0.82

**$p<0.01$
males ($n = 202$); females ($n = 232$)
EL=English Language

Whereas ANOVA was used to test the statistical significance of sex differences for each scale, effect sizes were used to describe the magnitude, or educational importance, of sex differences as recommended by Cohen (1988). An effect size, which is calculated by dividing the difference between males' and females' means by the pooled standard deviation for a scale, expresses sex differences in standard deviation units. According to Cohen (1988), effect sizes of 0.20 can be considered small, of 0.50 can be considered medium and of 0.80 can be considered large.

Table 4.4 reveals statistically significant ($p<0.01$) sex differences for two of the six WIHIC scales – Task Orientation and Cooperation – and neither attitude scale. For these two scales, female students had more positive perceptions than male students. They perceived their classrooms as more task-oriented and cooperative than male students did.

For these two scales, the effect sizes of 0.35 and 0.37 standard deviations fall in the small to modest range. This suggests a modest difference of some educational importance for these two areas between male and female students. The effect sizes for the other learning environment and attitude scales, whose magnitudes ranged from 0.04 to 0.17 standard deviations, reflect very small and unimportant sex difference in learning environment perceptions and attitudes.

Table 4.4 also reports the average item mean (derived by dividing the scale mean by the number of items in that scale) for every learning environment and attitude scale. Interestingly, the difference in scale scores between males and females (although small in most cases) was consistently in the same direction for all eight scales. It seems that, relative to males, female students had somewhat more positive perceptions of their learning environment as well as somewhat more positive attitudes and academic efficacy for the English Language.

The results are consistent with past studies which revealed significant differences between males and females in terms of students' learning environment perceptions and attitudes (den Brok, Fisher, Rickards & Bull, 2006; Hoang, 2008; Ogbuehi & Fraser, 2007), with females reporting more favourable perceptions and attitudes.

4.6 Ethnic Differences in Learning Environment Perceptions and Attitudes

The same sample of 441 primary students in 22 classes (279 Chinese and 89 Malays) was used to investigate ethnic differences in students' perceptions of the learning environment and attitudes in primary English Language classrooms. Approximately 63.3% of the students were Chinese and 20.2% of the students were Malay. 73 students were either of another race (e.g. Indian) or failed to indicate whether they were Chinese or Malay. The disproportional number of Chinese students (n=279) and Malay students (n=89) would have reduced the statistical power of my comparisons of these

two ethnic groups, thus making it more difficult to detect significant differences.

This section reports results for the other part of the second research objective concerning differences in students' perceptions of the learning environment and attitudes in primary English classrooms between Chinese and Malay students.

Ethnic differences were examined using the same procedures involving MANOVA and effect sizes that were used for sex differences (Section 4.5). Chinese students' mean and Malay students' mean were calculated for each scale as shown in Table 4.5.

TABLE 4.5
Average Item Mean, Average Item Standard Deviation and Ethnic Difference (Effect Size and ANOVA Result) for Each Learning Environment and Attitude Scale

Scale	Average Item Mean		Average Item SD		Difference	
	Chinese	Malay	Chinese	Malay	Effect Size	*F*
Learning Environment						
Student Cohesiveness	4.01	4.11	0.61	0.39	0.19	1.22
Teacher Support	3.79	4.02	0.73	0.64	0.33	1.62**
Involvement	3.46	3.68	0.73	0.62	0.32	1.61**
Task Orientation	4.21	4.26	0.59	0.61	0.08	0.81
Cooperation	4.01	4.05	0.67	0.57	0.06	0.76
Equity	3.81	3.91	0.83	0.57	0.14	1.04
Attitudes						
Attitude to EL	3.78	4.24	0.98	0.72	0.53	2.01**
Academic Efficacy	3.04	3.19	0.90	0.75	0.18	1.20

**$p<0.01$
Chinese ($n = 279$); Malay ($n = 89$)

ANOVA results revealed statistically significant ($p<0.01$) ethnic differences for two WIHIC scales (Teacher Support and Involvement) and for Attitude to English Language. For these three scales, Malay students had more positive scores than Chinese students. That is, Malay students perceived more

Teacher Support and Involvement in the classroom and had more positive attitudes compared with Chinese students.

These statistically significant ethnic differences were associated with effect sizes ranging from 0.32 to 0.53 standard deviations for these three scales, putting them in the modest to medium range (Cohen, 1988) for effect sizes.

The effect sizes for ethnic differences for the other scales, whose magnitudes ranged from only 0.06 to 0.19 standard deviations, reflect the smallness of the ethnic difference in learning environment perceptions and efficacy for these scales.

Table 4.5 also shows the average item and the direction of ethnic differences for each scale. The results reported in this table seem to suggest that, relative to Chinese students, Malay students consistently tended to have more positive perceptions of their learning environment as well as a more positive attitude and academic efficacy of the English Language. This is somewhat consistent with previous studies' findings (Hoang, 2008; Koul and Fisher, 2005; Tulloch, 2011) which supports the notion that students who come from different cultural backgrounds can perceive their learning environment differently.

4.7 Associations between Students' Attitudes and Efficacy and the Learning Environment

This section focuses on associations between WIHIC scales and students' attitudes and efficacy in the English Language as presented in Table 4.6. This involves my third research question. The same sample of 441 primary students in 22 classes (202 males and 232 females) was used.

Simple correlations (*r*) were used to indicate the strength of the bivariate association between each WIHIC scale and each attitude. Multiple regression analysis was conducted for each attitude measure to provide information about the joint influence of correlated WIHIC scales on attitude and academic efficacy. The standardised regression coefficient (β) was used to describe

the association between an attitude and a particular WIHIC scale when the effect of the other WIHIC scales was kept constant.

Table 4.6 shows that the simple correlation between each of the six WIHIC scales and each attitude and academic efficacy scale was statistically significant (p<0.01). These results suggest that both Attitude to English and Academic Efficacy were more positive in classrooms that were perceived more favourably on all WIHIC scales.

Simple correlation (r) with the WIHIC scales ranged from 0.25 to 0.46 for Attitudes and from 0.27 to 0.39 for Academic Efficacy. According to Cohen (1988), effect sizes (using r values) of 0.10 can be considered small (relationships of this size would not be perceptible on the basis of casual observation), 0.30 can be considered medium (the degree of relationship would be perceptible to the naked eye of a reasonably sensitive observer) and 0.50 can be considered large (relationships are about as high as they can get). This places the effect sizes (when r value is used) for associations between the WIHIC scales and both the Attitudes and Academic Efficacy scales predominantly in the medium range according to Cohen's (1988) criteria.

TABLE 4.6
Simple Correlation and Multiple Regression Analyses for Associations Between Learning Environment and Attitude Scales

Scale	Attitude-Environment Associations			
	Attitude to English		Academic Efficacy	
	r	β	r	β
Student Cohesiveness	0.25**	0.08	0.32**	0.07
Teacher Support	0.45**	0.17**	0.27**	0.03
Involvement	0.40**	0.14*	0.39**	0.22**
Task Orientation	0.43**	0.18**	0.29**	0.03
Cooperation	0.37**	0.04	0.34**	0.05
Equity	0.46**	0.18**	0.35**	0.19**
Multiple Correlation, R		0.54**		0.44**

*p<0.05, **p<0.01

Multiple regression analysis for the set of WIHIC scales revealed a multiple correlation of 0.54 for Attitude to English and 0.44 for Academic Efficacy. These multiple correlations were statistically significant (p<0.01).

To determine which of the learning environment scales contributed most to these multivariate associations, the standardised regression coefficients (β) were examined. Beta weights revealed that Teacher Support, Involvement, Task Orientation and Equity were positively, significantly and independently associated with Attitude to English. This suggests that students adopt a more positive attitude in primary English classrooms where they perceive classrooms to be more task-oriented and where teachers provide more support and treat each student equitably.

The standardised regression coefficient (β) was also used to identify which WIHIC scales contributed uniquely and significantly to the explanation of variance in Efficacy. Beta weights revealed that Involvement and Equity were significant independent predictors of Efficacy. This suggests that, in classes where students saw themselves more involved and teachers treating them more equitably, they tended to possess higher levels of Efficacy in the English Language.

In this study, every bivariate and multivariate relationship in Table 4.6 was positive. This replicates many past studies that revealed positive links between student attitudes and the learning environment (Allen & Fraser, 2007; Fraser, 2013; Ogbuehi & Fraser, 2007; Wolf & Fraser, 2008).

4.8 Summary and Conclusions

This chapter focused on the presentation and interpretation of findings to address the research aims:

i. To modify and validate questionnaires for assessing the learning environment and student attitudes specifically in primary English Language classrooms

ii. To investigate differences in students' perceptions of the learning environment and attitudes in primary English Language classrooms between:
    a. male and female students
    b. Chinese and Malay students
ii. To investigate associations between students' attitudes and the learning environment of primary English Language classrooms.

The study involved a sample of 441 students in 22 primary classrooms. 202 male students were compared with 232 female students and 279 Chinese students were compared with 89 Malay students.

For the first objective concerned with the validity and the reliability of the learning environment and attitude scales used (from the WIHIC, TOSRA and MJSES with slight modification), factor analysis supported the a priori six-scale structure of the WIHIC and revealed that the proportion of variance accounted for ranged from 2.77% to 32.91% for different scales, with the total proportion of variance being 55.61%. The eigenvalues ranged from 1.33 to 15.79. The alpha reliability coefficient for different WIHIC scales ranged from 0.81 to 0.92 when the individual student was used as the unit of analysis, and from 0.77 to 0.91 when the class mean was used as the unit of analysis. The discriminant validity of the WIHIC scales (using the mean correlation of other scales) ranged from 0.42 to 0.51 when the individual student mean was used as the unit of analysis, and from 0.27 to 0.44 when the class mean was used as the unit of analysis. Although these values suggest some overlap in raw scores on WIHIC scales, the factor analysis provided strong support for the factor structure and independence of factor scores.

Factor analysis also supported a two-factor structure for the modified TOSRA and MJSES, with 51.55% of the variance accounted for by Attitude to English Language and 17.31% for Academic Efficacy. The total proportion of variance accounted for was 68.86%. The alpha reliability coefficient for Academic Efficacy was 0.90 and for Attitude to English Language was 0.95, when the individual student was used as the unit of analysis. When the class

mean was used as the unit of analysis, the alpha reliability coefficients were 0.94 for Academic Efficacy and 0.97 for Attitude to English Language. The factorial validity and reliability of the two-scale modified versions of the TOSRA and MJSES were supported when used with neighbourhood primary schools in Singapore.

The second research objective involved sex and ethnic (Chinese and Malay) differences in students' perceptions of their learning environment and attitudes. MANOVA revealed statistically significant sex differences in Task Orientation and Cooperation, with effect sizes of 0.35 and 0.37 standard deviations, respectively, placing these two scales in the small to modest range (Cohen, 1988). Interestingly, differences in scale scores between males and females were consistently in the same direction for all eight scales, suggesting that female students had somewhat more positive perceptions of their learning environment and somewhat more positive attitudes and academic efficacy in relation to the English Language.

MANOVA also revealed statistically significant ethnic differences in Teacher Support, Involvement and Attitude to English Language with effect sizes ranging from 0.32 to 0.53 standard deviations, placing these magnitudes in the modest to medium range (Cohen, 1988). Differences in scale scores between Chinese and Malay were consistently in the same direction for all eight scales, suggesting that Malay students consistently tended to have more positive perceptions of their learning environment as well as more positive attitudes and academic efficacy in relation to the English Language.

The third research aim focused on associations between students' attitudes and the learning environment of primary EL classrooms. Simple correlation analysis revealed that all learning environment scales were significantly and positively correlated with both attitude to English and academic efficacy. For attitudes to English, correlations ranged from 0.25 (Student Cohesiveness) to 0.46 (Equity). For academic efficacy, correlations ranged from 0.27 (Teacher Support) to 0.39 (Involvement). The effect sizes (*r* index) for associations with WIHIC scales ranged from 0.25 to 0.46 for attitude to English Language

and from 0.27 to 0.39 for Academic Efficacy. This places them in the modest to medium range (Cohen, 1988).

The multiple correlation for the set of WIHIC scales was 0.54 for Attitude to English and 0.44 for Academic Efficacy, and was statistically significant ($p<0.01$) in each case. To determine which of the learning environment scales contributed most to these multivariate associations, the standardized regression coefficients (β) were examined. Teacher Support, Involvement, Task Orientation and Equity were positively, significantly and independently associated with attitude to English, whereas Involvement and Equity were significant independent predictors of efficacy.

The next chapter discusses the key findings of this study, its contribution to learning environments research and its limitations, as well as making some recommendations for future research.

Chapter 5

SUMMARY AND CONCLUSION

5.1 Introduction

This final chapter synthesises information presented in the earlier chapters and explores possibilities for the future. In brief, this study sought to: (1) modify and validate existing questionnaires (the WIHIC, the TOSRA and the MJSES) for assessing the learning environment and student attitudes specifically in primary English Language (EL) classrooms; (2) investigate differences between male and female students and between Chinese and Malay students in their perceptions of the learning environment and attitudes in primary EL classrooms; and (3) investigate associations between students' attitudes and the learning environment of primary EL classrooms. This study was conducted with 441 students in 22 classes in Singapore.

This chapter concludes this thesis and is organised using the following sections:

5.2 Summary of the Thesis
5.3 Major Findings of the Study
5.4 Contributions of the Study
5.5 Limitations of the Study
5.6 Recommendations for Future Research
5.7 Summary and Concluding Remarks.

5.2 Summary of the Thesis

This thesis was divided into five chapters. Chapter 1 paved the way by situating the study in a given context by establishing its background, providing a theoretical framework, and stating explicitly the research aims and objectives. In addition, it discussed the learning environment and attitude instruments that were unique to this study, namely, the What Is Happening In

this Class? (WIHIC), the Test of Science-related Attitudes (TOSRA) and the Morgan-Jinks Student Efficacy Scale (MJSES). It deliberated on the significance of this study before, finally, concluding the chapter with an overview of the rest of the thesis chapters.

Chapter 2 reviewed literature pertinent to this study. It acknowledged historically-significant contributions in the past and traced briefly the development of the field of learning environments. It reviewed the range of learning environment instruments that emerged, as well as the types of past research undertaken on learning environment. Because this study also investigated the impact of some classroom environment determinants (sex differences and ethnic differences), literature on these aspects was also reviewed. As well, literature on attitudes and self-efficacy was reviewed to provide an appreciation of the complexities of these constructs, as well as a focus on more frequently-used instruments in past studies.

Chapter 3 described the research methods used for this study. It began with stating the specific research questions that arose:

Research Question 1a
Is the WIHIC valid and reliable when used in a primary English Language classroom in Singapore?

Research Question 1b
Is an attitude scale based on the TOSRA and the self-efficacy scale based on the MJSES valid and reliable when used with primary children in English Language classroom in Singapore?

Research Question 2
Are there differences in students' perceptions of the learning environment and attitudes in primary English Language classrooms between:

a. male and female students
b. Chinese and Malay students?

Research Question 3

Are there associations between students' attitudes and the learning environment of primary English Language classrooms?

Chapter 3 described the whole sample of 441 students in four schools that consisted of 202 males and 232 females, and 279 Chinese students and 89 Malay students. This sample was reasonably representative of the average Singaporean classroom where there is a higher population of females and where Chinese is the dominant race in the country. Sections in this chapter were devoted to more detailed descriptions of the instruments used – the WIHIC, the TOSRA and the MJSES – with one part covering the assembling of the final instrument used in this study. Information was also provided about the administration of the instrument. This was followed by a discussion of data-collection procedures and data-analysis methods used to address each of the specific research questions.

Chapter 4 reported the results based on the analysis procedures used to address the research questions. The first set of findings reported focussed on the validity and reliability of the scales used. To address the second research question, sections were devoted to reporting sex and ethnic differences. The last set of results, which addressed the third research question, involved associations between students' attitudes and efficacy and the learning environment. Key results in this chapter are recapitulated and summarised in the next section of this chapter (Section 5.3).

Chapter 5 concludes the thesis by providing an overview of the entire thesis. It first introduces the study, briefly situating it once again in a given context, and then it recapitulates the essence of each chapter. Major findings are summarised followed by a discussion of the contributions and limitations of the current study. This chapter ends with recommendations about how the findings might be enhanced and/or extended in future research.

5.3 Major Findings of the Study

For each of this study's three specific questions, the major findings are summarised in detail in the following paragraphs.

5.3.1 Research Question 1

The research instrument (a combination of the WIHIC, the TOSRA and the MJSES with slight modifications) was administered to the 441 students in one sitting. Statistical analyses of the data were then undertaken to check factor structure, internal consistency reliability and ability to differentiate between classes.

Principal axis factoring followed by varimax rotation and Kaiser normalisation confirmed the *a priori* structure of the 48 items from the WIHIC, as well as 8 items from the TOSRA and 8 items from the MJSES. Only one item had to be eliminated (Item 8 from one of the scales of the WIHIC) based on the criteria that its loading needed to be at least a 0.40 on its own scale and less than 0.40 on all of the other scales.

Factor analysis of data for the six learning environment scales from the WIHIC revealed that the proportion of variance accounted for ranged from 2.77% to 32.91%, with the total proportion of the variance calculated to 55.61%. The eigenvalues ranged from 1.33 to 15.79. Factor analysis for the TOSRA and MJSES revealed that the proportion of variance was 51.55% (Attitude to English Language) and 17.31% (Academic Efficacy). The total proportion of variance accounted for was 68.86%. The eigenvalues were 2.77 for Academic Efficacy and 8.49 for Attitude to English Language. The factor analyses strongly support for the factorial validity of the six-scale modified version of the WIHIC and the two-scale adapted versions of the TOSRA and the MJSES when used with neighbourhood primary schools in Singapore.

Further analyses indicated sound internal consistency reliability (using Cronbach's alpha coefficient) for the six-scale version of the modified version of the WIHIC and the two-scale adapted versions of the TOSRA and the MJSES. Two units of analysis (individual student score and class mean) were used. The alpha reliability coefficients for the WIHIC scales ranged from 0.81 to 0.92 when the individual student was used as the unit of analysis, and from 0.77 to 0.91 when the class mean was used as the unit of analysis. For the two-scale version of the TOSRA and the MJSES, the alpha reliability coefficient was 0.95 for the TOSRA scale (Attitude to English Language) and 0.90 for the MJSES scale (Academic Efficacy) when the individual student was used as the unit of analysis. When the class mean was used as the unit of analysis, the alpha coefficient was 0.97 for the TOSRA scale (Attitude to English Language) and 0.94 for the MJSES scale (Academic Efficacy).

Finally, an analysis of variance (ANOVA) was used for each of the scales of the WIHIC to check the instrument's ability to differentiate between the perceptions of the students in the 22 classrooms. The eta^2 statistics (representing the proportion of variance) ranged from 0.03 to 0.07 for different WIHIC scales. Because these eta^2 values were small and not statistically significant in this study, it seems that students' perceptions of the primary EL classrooms were not too diverse. Ability to differentiate between classrooms was not relevant for the TOSRA scale (Attitude to English Language) and the MJSES scale (Academic Efficacy).

Overall, these findings replicated past validity results in various countries for the WIHIC (Aldridge Fraser & Huang, 1999; Helding & Fraser, 2013; Ogbuehi & Fraser, 2007), for the TOSRA (Fraser, Aldridge & Adolphe, 2010; Henderson, Fisher & Fraser, 2000; Wolf & Fraser, 2008) and for the MJSES (Afari, Aldridge, Fraser & Khine, 2013; Dorman, 2008; Gupta & Fisher, 2012).

5.3.2 Research Question 2

The second research objective involved sex and ethnic (Chinese and Malay) differences in students' perceptions of their learning environment and

attitudes. To investigate the second research question, MANOVA was undertaken with the six scales of the WIHIC and the two attitude scales (TOSRA and MJSES) serving as the correlated dependent variables. Because Wilks' lambda criterion revealed statistically significant sex and ethnic differences for the set of variables as a whole, the univariate ANOVA results were interpreted separately for each dependent variable. Statistically significant sex differences occurred for Task Orientation and Cooperation, with effect sizes of 0.35 and 0.37 standard deviations, respectively, placing these two scales in the small to modest range (Cohen, 1988). It was also found that differences in scale scores between males and females were consistently in the same direction for all eight scales, suggesting that female students had somewhat more positive perceptions of their learning environment and somewhat more positive attitudes and academic efficacy regarding the English Language.

Ethnic differences were statistically significant for the two WIHIC scales of Teacher Support and Involvement. Effect sizes of 0.32 and 0.53 standard deviations for these two scales placed them in the modest magnitude range (Cohen, 1988). Differences in scale scores between Chinese and Malay students were consistently in the same direction for all eight scales, with Malay students consistently having more positive perceptions of their learning environment as well as more positive attitudes and academic efficacy for the English Language.

5.3.3 Research Question 3

The third research aim focused on associations between students' attitudes and the learning environment of primary EL classrooms. When simple correlations were used to indicate the strength of the bivariate association between each WIHIC scale and each attitude, all learning environment scales were significantly and positively correlated with both attitudes to English and academic efficacy. For attitudes to English, attitude–environment correlations ranged from 0.25 (Student Cohesiveness) to 0.46 (Equity). For academic efficacy, correlations ranged from 0.27 (Teacher Support) to 0.39

(Involvement). The results suggest that both Attitude to English and Academic Efficacy were more positive in classrooms that were perceived more favourably on all WIHIC scales. The range of correlations from 0.25 to 0.46 for Attitude and from 0.27 to 0.39 from Academic Efficacy places all correlation coefficients in the modest to medium range (Cohen, 1988).

The multiple correlation for the set of WIHIC scales was 0.54 for Attitude to English and 0.44 for Academic Efficacy, and was statistically significant ($p<0.01$) in each case. To determine which of the learning environment scales contributed most to these multivariate associations, the standardised regression coefficients (β) were examined. Teacher Support, Involvement, Task Orientation and Equity were positively, significantly and independently associated with Attitude to English, whereas Involvement and Equity were significant independent predictors of Efficacy.

It is noteworthy that every bivariate and multivariate relationship that surfaced in the analyses was positive. This replicates past studies for which positive links were established between student attitudes and the learning environment (Allen & Fraser, 2007; Fraser, 2012; Ogbuehi & Fraser, 2007; Wolf & Fraser, 2008).

5.4 Contributions of the Study

This study is one of many in the field of learning environment research. It was established in the introductory chapter that this field is important because of the sheer amount of time that a student spends in the classroom. The uniqueness of this study lies in its focus on the primary classroom in an Asian country and on the school subject of English Language. Chapter 2 reviews the extensive past research undertaken on learning environments and the variety of instruments developed for measuring classroom environment, mostly at the secondary level and, to a certain extent, at the tertiary level of education. The focus of past research has been mainly on content subjects, especially science. My study focused on different learning environments, namely, primary English Language classrooms in Singapore.

This study is important because it has also provided further evidence of validity and reliability of the WIHIC and the single scales from the TOSRA and the MJSES when used specifically with primary English Language classes in Singapore.

The final important contribution of this study has to do with the provision of insight into sex and ethnicity differences in learning environment perceptions. Few past studies have investigated the influence of these factors as determinants of the learning environment. While the study is not definitive in itself, it can provide some considerations for the primary English Language classrooms with respect to these two determinants.

Findings for the first determinant (sex) revealed that females had somewhat more positive perceptions of their learning environment and somewhat more positive academic efficacy. MANOVA revealed statistically significant differences for males and females with regard to Task Orientation and Cooperation. Findings for ethnicity as the second determinant revealed that Malay students had more positive scores than Chinese students, with Teacher Support and Involvement being statistically different for the two ethnicities.

These insights could increase English teachers' awareness of the need to support male students in the area of task orientation and cooperation and teacher support and involvement for Chinese students. This might entail reviewing instructional materials and adopting or modifying teaching strategies to better engage male students as well as Chinese students. Having teachers' awareness raised is the first step to making these changes in the classroom.

5.5 Limitations of the Study

Several considerations have to be taken account in the interpretation of the results of my study. For one, the sample size of 441 students was relatively small, involving four governmental coeducational schools. The findings, thus,

can only be confined to this context and should not be generalised to partially autonomous schools nor to single-sex schools. The small sample size would also make generalisability of the findings of the research limited.

Another limitation of this study was its dependence on collecting quantitative data. While the instruments used have been previously validated and found to be reliable, a more complete picture might have been obtained if triangulation of a wider variety of data had been possible. Tobin and Fraser (1998) strongly advocate the combination of both qualitative and quantitative research data, noting that the triangulation of both of these two types of data add to the "fruitfulness (and)…richness" in classroom environment research (p. 290). Patton (2002) further supports this when he notes that a mix of these two types of data enriches evaluations and that the provision of open-ended responses allows elaboration and contextualisation of statistical facts. Interview questions, for example, could have allowed a deeper analysis of students' perceptions of the classroom and provided a useful channel for clarification and for enhancing the research findings. Unfortunately, because of time constraints and difficulties in the coordination of schedules, extensive interviews could not be included. The absence of interviews might have resulted in the loss of richness in responses because data were confined to the five-point response choices for each item. Collection of qualitative information might have helped to confirm (or even contradict) statistical findings.

An additional potential limitation associated with the sample is the disproportionate number of Chinese students (n=279) and Malay students (n=89). This could have reduced the statistical power of my ethnic comparisons. This problem was unavoidable because of the differential proportions of these ethnic groups attending the schools in my sample.

A third *limitation p*ossibly could be that modifying the research instruments might have led to the loss of validity. The original use of the selected instruments (WIHIC, TOSRA and MJSES) was in science or mathematics classes. Furthermore, these instruments were previously used predominantly

in secondary-level classes. As the present research was undertaken in primary English Language classes, parts of these questionnaires had to be modified and adapted for use in that context. This could have resulted in issues to do with concepts not carrying over from one discipline to another and from one educational level to the other.

Having only two student outcomes (attitude and efficacy) was also a potentially limiting. Including the cognitive domain (e.g. students' achievement) could have resulted in a more holistic picture of the effects of the learning environment and its determinants and effects.

As with any research undertaken, the possibility of researcher bias is a potential limitation of the study. While care was taken to report the results of this study as objectively as possible, one cannot completely eliminate the possibility that the results were influenced by the context and culture of the classroom as understood by the researcher.

In summary, generalising the findings of this research would warrant caution because of limitations of the data-collection methods and the relatively small size sample. The applicability of findings should be confined to primary English Language classrooms in Singapore.

5.6 Recommendations for Future Research

Although there are limitations to this study, nevertheless, it has made a contribution to the field of learning environment. This study provides a foundation upon which future research involving the determinants and effects of learning environments can be built.

However, future studies ideally should opt for a mixed-methods approach involving both quantitative and qualitative data. This is likely to enrich the insights gleaned from the study.

My relatively small size sample offered some insights into the learning environment in a Singaporean primary English Language setting. This could be further illuminated in future studies involving larger and more diverse samples from a wider range of disciplines in the primary school setting. Perhaps, this study could be developed further to involve a cross-national sample across Asian countries, thus increasing the generalisability of the findings.

Other domains of student outcomes could also be considered as mentioned in the previous section. The inclusion of student achievement, in particular, could enhance the picture of the relationship between the learning environment and student outcomes.

It might also be useful in future research to collect data across a range of grade levels so that it can be determined whether sex and ethnic differences vary with grade level and, if so, possibly to identify the variations that occur between grade levels.

5.7 Summary and Concluding Remarks

This study involving 441 students (aged 11–12 years old) from 22 Singaporean English Language classes (across four schools) provided answers to the three research questions:

(1) the validity and reliability of learning environment and attitude questionnaires
(2) sex and ethnic differences in learning environment perceptions and attitudes in primary English classrooms in Singapore
(3) associations between students' attitudes and the learning environment.

A summary of research findings follows:

- The modified questionnaires (WIHIC, TOSRA and MJSES scales with slight modification) were valid and reliable measures of students'

perceptions of classroom environment and attitudes when used with primary school children in their English Language classroom in Singapore. The findings replicated previous studies incorporating these instruments.

- Females had more favourable perceptions of their English Language classrooms as well as more a more positive attitudes and academic efficacy for English Language relative to their male counterparts. Task Orientation and Cooperation were perceived to be significantly higher by females. This replicates similar findings reported by den Brok, Fisher, Rickards and Bull (2006), Hoang (2008) and Sullivan, Riccio and Reynolds (2008).

- Malay students had more favourable perceptions of their English Language classrooms as well as more a more positive attitudes and academic efficacy relative to Chinese students. Teacher Support and Involvement were perceived to be significantly higher by Malay students than by Chinese students. This is somewhat consistent with the findings reported by Koul and Fisher (2005).

- Positive associations were found between attitudes to English and academic efficacy and students' perceptions of the English classroom environment. In particular, Involvement and Equity were significant independent predictors of efficacy. When students perceived themselves more involved in the English classroom and when teachers treated them more equitably, they tended to have higher levels of efficacy in English. This replicates past studies (Allen & Fraser, 2007; Ogbuehi & Fraser, 2007; Wolf & Fraser, 2008).

Though there were limitations to the study, it was able to provide worthwhile insights in the field of learning environments. A major contribution is the provision of further validity and reliability support for the instruments (WIHIC, and single scales of TOSRA and MJSES) when used to assess classroom environment and attitudes in Singapore. In addition, my study supported the

versatility of the instruments for use in the English classroom and for primary children. Findings also replicated the link between the learning environment and students' attitudes and efficacy.

In view of the importance of learning environment as discussed in Chapter 1, this study is further proof that the learning environment can hardly be downplayed in today's context. This study has provided me with much insight into the possible links between the learning environment and students' attitudes and has opened up even more possibilities of stronger connections that could exist. As Fraser (2007, p. 13) puts it, the learning environment is one important aspect that must be considered to gain "a complete picture of the educational process". This study thus served a personal goal as well. It is a small attempt by an educator to take steps to make progress in this area with the hope of further development in a larger landscape.

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Appendix A

List of Websites Describing Recent Singapore Educational Policies

MOE Initiative/Policy	***Website URL***
Minister of Education's speech (Mr Tharman Shanmugaratnam), 2005	http://www.moe.gov.sg/media/press/2005/pr20050922b.htm
Teach Less, Learn More	http://www3.moe.edu.sg/bluesky/tllm.htm
PETALS™ (Use of Pedagogies, Experiences of Learning, Tone of Environment, Assessment for Learning, and Learning Content)	http://www.moe.gov.sg/media/press/2008/01/more-support-for-schools-teach.php
English Language Syllabus 2001	http://www.moe.gov.sg/education/syllabuses/languages-and-literature/files/english-primary-secondary.pdf
English Language Syllabus 2010	http://www.moe.gov.sg/education/syllabuses/languages-and-literature/files/english-primary-secondary-express-normal-academic.pdf
SEED (Strategies for Engaged and Effective Development)	http://www.stellarliteracy.sg/cos/o.x?c=/wbn/pagetree&func=view&rid=20699
STELLAR (Strategies for English Language Learning and Reading Programme)	

Appendix B

Classroom Environment & Attitude Questionnaire

Directions
This questionnaire has two parts:
Part 1 contains statements about practices which could take place in your English Language class.
Part 2 contains statements about how you feel about English Language as a subject.

Think about how often each statement is true for you. Draw a circle around

1	if the statement is true	ALMOST NEVER
2	if the statement is true	SELDOM
3	if the statement is true	SOMETIMES
4	if the statement is true	OFTEN
5	if the statement is true	ALMOST ALWAYS

Be sure to give an answer for ALL questions. If you change your mind about an answer, just cross it out and circle another.

There are no 'right' or 'wrong' answers. Your opinion is what is wanted.

Practice Example. Suppose you were given a statement: "I make friendships among other students in this class." You would need to decide whether you think that this statement is true *Almost Never*, *Seldom*, *Sometimes*, *Often* or *Almost Always*. If you selected *Almost Always*, you would circle number 5 on your Answer Sheet.

No.	Item	Almost Never	Seldom	Sometimes	Often	Almost Always
Student Cohesiveness						
1	I make friendships among students in this class.	1	2	3	4	(5)

Don't forget to write your name and other details at the top of the reverse side of this page.

This questionnaire is based on the WIHIC (Aldridge, Fraser & Huang, 1999), the TOSRA (Fraser, 1981) and the MJSES (Jinks & Morgan, 1999). These questionnaires were modified for use in my study and included in this thesis with the permission of the authors.

School	
Name (reg no.)	( )
Gender	Male / Female [Pls delete where applicable]
Race	Chinese / Malay / Indian / Others [Pls delete where applicable]

Part 1: Practices in the EL classroom

No.	Item	Almost Never	Seldom	Sometimes	Often	Almost Always
Student Cohesiveness						
1	I make friendships among students in this class.	1	2	3	4	5
2	I know other students in this class.	1	2	3	4	5
3	I am friendly to members of this class.	1	2	3	4	5
4	Members of the class are my friends.	1	2	3	4	5
5	I work well with other class members.	1	2	3	4	5
6	I help other class members who are having trouble with their work.	1	2	3	4	5
7	Students in this class like me.	1	2	3	4	5
8	In this class, I get help from other students.	1	2	3	4	5
Teacher Support						
9	The teacher considers my feelings.	1	2	3	4	5
10	The teacher helps me when I have trouble with the work.	1	2	3	4	5
11	The teacher talks with me.	1	2	3	4	5
12	The teacher is interested in my problems.	1	2	3	4	5
13	The teacher moves about the class to talk with me.	1	2	3	4	5

No.	Item	Almost Never	Seldom	Sometimes	Often	Almost Always
14	The teacher helps me to understand.	1	2	3	4	5
15	The teacher breaks down class tasks to help me learn better.	1	2	3	4	5
16	The teacher helps me to tell the difference between EL and Singlish.	1	2	3	4	5
Involvement						
17	I discuss ideas in class.	1	2	3	4	5
18	I give my opinions during class discussions.	1	2	3	4	5
19	The teacher asks me questions.	1	2	3	4	5
20	My ideas and suggestions are used during classroom discussions.	1	2	3	4	5
21	I ask the teacher questions.	1	2	3	4	5
22	I explain my idea to other students.	1	2	3	4	5
23	Students discuss with me how to go about solving problems.	1	2	3	4	5
24	I am asked to explain how I solve problems.	1	2	3	4	5
Task Orientation						
25	Getting a certain amount of work done is important to me.	1	2	3	4	5
26	I do as much as I set out to do.	1	2	3	4	5
27	I know the goals for this class.	1	2	3	4	5
28	I am ready to start this class on time.	1	2	3	4	5
29	I know what I am trying to accomplish in this class.	1	2	3	4	5
30	I pay attention during this class.	1	2	3	4	5

No.	Item	Almost Never	Seldom	Sometimes	Often	Almost Always
31	I try to understand the work in this class.	1	2	3	4	5
32	I know how much work I have to do.	1	2	3	4	5
Cooperation						
33	I cooperate with other students when doing assignment work.	1	2	3	4	5
34	I share my books and resources with other students when doing assignments.	1	2	3	4	5
35	When I work in groups in this class, there is teamwork.	1	2	3	4	5
36	I work with other students on projects in this class.	1	2	3	4	5
37	I learn from other students in this class.	1	2	3	4	5
38	I work with other students in this class.	1	2	3	4	5
39	I cooperate with other students on class activities.	1	2	3	4	5
40	Students work with me to achieve class goals.	1	2	3	4	5
Equity						
41	The teacher gives as much attention to my questions as to other students' questions.	1	2	3	4	5
42	I get the same amount of help from the teacher as do other students.	1	2	3	4	5
43	I have the same amount of say in this class as other students.	1	2	3	4	5
44	I am treated the same as other students in this class.	1	2	3	4	5

No.	Item	Almost Never	Seldom	Sometimes	Often	Almost Always
45	I receive the same encouragement from the teacher as other students do.	1	2	3	4	5
46	I get the same opportunity to contribute to class discussions as other students.	1	2	3	4	5
47	My work receives as much praise as other students' work.	1	2	3	4	5
48	I get the same opportunity to answer questions as other students.	1	2	3	4	5

Part 2: How you feel about EL

No.	Item	Almost Never	Seldom	Sometimes	Often	Almost Always
Attitude to EL						
49	I look forward to lessons in EL.	1	2	3	4	5
50	Lessons in EL are fun.	1	2	3	4	5
51	I like lessons in EL.	1	2	3	4	5
52	Lessons in EL excite me.	1	2	3	4	5
53	EL is one of the most interesting school subjects.	1	2	3	4	5
54	I enjoy lessons in EL.	1	2	3	4	5
55	Lessons in EL are meaningful to me.	1	2	3	4	5
56	These lessons make me interested in EL.	1	2	3	4	5
Academic Efficacy						
57	I find it easy to get good grades in EL.	1	2	3	4	5
58	I am good at EL.	1	2	3	4	5

No.	Item	Almost Never	Seldom	Sometimes	Often	Almost Always
59	My friends ask me for help in EL.	1	2	3	4	5
60	I find EL easy.	1	2	3	4	5
61	I do better than most of my classmates in EL.	1	2	3	4	5
62	I can pass EL without having to work too hard.	1	2	3	4	5
63	I am an intelligent student.	1	2	3	4	5
64	I help my friends with their homework in EL.	1	2	3	4	5

Appendix C

Items in the What Is Happening In this Class? (WIHIC) Questionnaire

Student Cohesiveness

1. I make friendships among students in this class.
2. I know other students in this class.
3. I am friendly to members of this class.
4. Members of the class are my friends.
5. I work well with other class members.
6. I help other class members who are having trouble with their work.
7. Students in this class like me.
8. In this class, I get help from other students.

Teacher Support

9. The teacher takes a personal interest in me.
10. The teacher goes out of his/her way to help me.
11. The teacher considers my feelings.
12. The teacher helps me when I have trouble with the work.
13. The teacher talks with me.
14. The teacher is interested in my problems.
15. The teacher moves about the class to talk with me.
16. The teacher's questions help me to understand.

Involvement

17. I discuss ideas in class.
18. I give my opinions during class discussions.
19. The teacher asks me questions.
20. My ideas and suggestions are used during classroom discussions.
21. I ask the teacher questions.
22. I explain my ideas to other students.
23. Students discuss with me how to go about solving problems.
24. I am asked to explain how I solve problems.

Investigation

25. I carry out investigations to test my ideas.
26. I am asked to think about the evidence for statements.
27. I carry out investigations to answer questions coming from discussions.
28. I explain the meaning of statements, diagrams, and graphs.
29. I carry out investigations to answer questions that puzzle me.
30. I carry out investigations to answer the teacher's questions.
31. I find out answers to questions by doing investigations.
32. I solve problems by using information obtained from my own investigations.

Task Orientation

33. Getting a certain amount of work done is important to me.
34. I do as much as I set out to do.
35. I know the goals for this class.
36. I am ready to start this class on time.
37. I know what I am trying to accomplish in this class.
38. I pay attention during this class.
39. I try to understand the work in this class.
40. I know how much work I have to do.

Task Orientation

41. I cooperate with other students when doing assignment work.
42. I share my books and resources with other students when doing assignments.
43. When I work in groups in this class, there is teamwork.
44. I work with other students on projects in this class.
45. I learn from other students in this class.
46. I work with other students in this class.
47. I cooperate with other students on class activities.
48. Students work with me to achieve these goals.

Equity

49. The teacher gives as much attention to my questions as to other students' questions.
50. I get the same amount of help from the teachers as do other students.
51. I have the same amount of say in this class as other students.
52. I am treated the same as other students in this class.
53. I receive the same encouragement from the teacher as other students do.
54. I get the same opportunity to contribute to class discussions as other students.
55. My work receives as much praise as other students' work.
56. I get the same opportunity to answer questions as other students.

Items are scored 1, 2, 3, 4, and 5, respectively, for the responses Almost Never, Seldom, Sometimes, Often, and Almost Always.

Source: Aldridge, Fraser & Huang (1999)

Appendix D

Items in the Test of Science-Related Attitudes (TOSRA)

1. Money spent on science is well worth spending.
2. Scientists usually like to go to their laboratories when they have a day off.
3. I would prefer to find out why something happens by doing an experiment than by being told.
4. I enjoy reading about things which disagree with my previous ideas.
5. Science lessons are fun.
6. I would like to belong to a science club.
7. I would dislike being a scientist after I leave school.
8. Science is man's worst enemy.
9. Scientists are about as fit and healthy as other people.
10. Doing experiments is not as good as finding out information from teachers.
11. I dislike repeating experiments to check that I get the same results.
12. I dislike science lessons.
13. I get bored when watching science programs on TV at home.
14. When I leave school, I would like to work with people who make discoveries in science.
15. Public money spent on science in the last few years has been used wisely.
16. Scientists do not have enough time to spend with their families.
17. I would prefer to do experiments than to read about them.
18. I am curious about the world in which we live.
19. School should have more science lessons each week.
20. I would like to be given a science book or a piece of scientific equipment as a present.
21. I would dislike a job in a science laboratory after I leave school.
22. Scientific discoveries are doing more harm than good.
23. Scientists like sport as much as other people do.
24. I would rather agree with other people than do an experiment to find out for myself.
25. Finding out about new things is unimportant.
26. Science lessons bore me.
27. I dislike reading books about science during my holidays.
28. Working in a science laboratory would be an interesting way to earn a living.
29. The government should spend more time on scientific research.
30. Scientists are less friendly than other people.

31. I would prefer to do my own research experiments than to find out information from a teacher.
32. I like to listen to people whose opinions are different from mine.
33. Science is one of the most interesting school subjects.
34. I would like to do science experiments at home.
35. A career in science would be dull and boring.
36. Too many laboratories are being built at the expense of the rest of education.
37. Scientists can have a normal family life.
38. I would rather find out about things by asking an expert than by doing an experiment.
39. I find it boring to hear about new ideas.
40. Science lessons are a waste of time.
41. Talking to friends about science after school would be boring.
42. I would like to teach science when I leave school.
43. Science helps to make life better.
44. Scientists do not care about their working conditions.
45. I would rather solve a problem by doing an experiment than be told the answer.
46. In science experiments, I like to use new methods which I have not used before.
47. I really enjoy going to science lessons.
48. I would enjoy having a job in a science laboratory during my school holidays.
49. A job as a scientist would be boring.
50. This country is spending too much money on science.
51. Scientists are just as interested in art and music as other people are.
52. It is better to ask the teacher the answer than to find it out by doing experiments.
53. I am unwilling to change my ideas when evidence shows that the ideas are poor.
54. The material covered in science lessons is uninteresting.
55. Listening to talk about science on the radio would be boring.
56. A job as a scientist would be interesting.
57. Science can help to make the world a better place in the future.
58. Few scientists are happily married.
59. I would prefer to do an experiment on a topic than to read about it in science magazines.
60. In science experiments, I report unexpected results as well as expected ones.

61. I look forward to science lessons.
62. I would enjoy visiting a science museum at the weekend.
63. I would dislike becoming a scientist because it needs too much education.
64. Money used on scientific projects is wasted.
65. If you met a scientist, he would probably look like anyone else you might meet.
66. It is better to be told scientific facts than to find them out from experiments.
67. I dislike listening to other people's opinions.
68. I would enjoy school more if there were no science lessons.
69. I dislike reading newspaper articles about science.
70. I would like to be a scientist when I leave school.

Scale Allocation and Scoring for Each Item

(S) Social Implications of Science	***(N) Normality of Scientists***	***(I) Attitude to Scientific Inquiry***	***(A) Adoption of Scientific Attitudes***	***(E) Enjoyment of Science Lessons***	***(L) Leisure Interest to Science***	***(C) Career Interest in Science***
1 (+)	2 (-)	3 (+)	4 (+)	5 (+)	6 (+)	7 (-)
8 (-)	9 (+)	10 (-)	11 (-)	12 (-)	13 (-)	14 (+)
15 (+)	16 (-)	17 (+)	18 (+)	19 (+)	20 (+)	21 (-)
22 (-)	23 (+)	24 (-)	25 (-)	26 (-)	27 (-)	28 (+)
29 (+)	30 (-)	31 (+)	32 (+)	33 (+)	34 (+)	35 (-)
36 (-)	37 (+)	38 (-)	39 (-)	40 (-)	41 (-)	42 (+)
43 (+)	44 (-)	45 (+)	46 (+)	47 (+)	48 (+)	49 (-)
50 (-)	51 (+)	52 (-)	53 (-)	54 (-)	55 (-)	56 (+)
57 (+)	58 (-)	59 (+)	60 (+)	61 (+)	62 (+)	63 (-)
64 (-)	65 (+)	66 (-)	67 (-)	68 (-)	69 (-)	70 (+)

Positive items are scored 1, 2, 3, 4, and 5, respectively, for the responses Strongly Disagree, Disagree, Not sure, Agree and Strongly Agree. Negative items are scored the reverse. Omitted or invalid responses are scored 3.

Source: Fraser (1981)

Appendix E

Items in the Morgan-Jinks Student Efficacy Scale (MJSES) Questionnaire

1. I work hard in school.
2. I could get the best grades in class if I tried enough.
3. Most of my classmates like to do math because it is easy.
4. I would get better grades if my teacher liked me better.
5. Most of my classmates work harder on their homework than I do.
6. I am a good science student.
7. I will graduate from high school.
8. I go to a good school.
9. I always get good grades when I try hard.
10. Sometimes I think an assignment is easy when the other kids in class think it is hard.
11. I am a good social studies student.
12. Adults who have good jobs probably were good students when they were kids.
13. When I am old enough, I will go to college.
14. I am one of the best students in my class.
15. No one cares if I do well in school.
16. My teacher thinks I am smart.
17. It is important to go to high school.
18. I am a good math student.
19. My classmates usually get better grades than I do.
20. What I learn in school is not important.
21. I usually understand my homework assignments.
22. I usually do not get good grades in math because it is too hard.
23. It does not matter if I do well in school.
24. Kids who get better grades than I do get more help from the teacher than I do.
25. I am a good reading student
26. It is not hard for me to get good grades in school.
27. I am smart.
28. I will quit school as soon as I can.
29. Teachers like kids even if they do not always make good grades.
30. When the teacher asks a question I usually know the answer even if the other kids don't.

Positive items are scored 1, 2, 3, and 4, respectively, for the responses Really Agree, Kind of Agree, Kind of Disagree, and Really Disagree.

MJSES Subscale Items

Talent Items	2, 6, 10, 11, 14, 16, 18, 19, 21, 25, 26, 27, 30
Context Items	3, 4, 7, 8, 12, 13, 15, 17, 20, 23, 24, 28, 19
Effort Items	1, 4, 9, 22

Source: Jinks & Morgan (1999)

Appendix F

Curtin University of Technology
School of Science and Mathematics Education Centre

Participant Information Sheet for Student Participant

My name is Donna and I am currently completing a piece of research for my PhD (Doctor of Philosophy - Science and Mathematics Education) at Curtin University of Technology.

Purpose of Research
I am investigating the classroom learning environment and student attitude towards English in the Singaporean classroom.

Your Role
I am interested in finding out your perception of your learning environment and your attitude towards English. I will need you to complete a questionnaire which will take approximately 30 minutes, which will be administered by your teacher.

Consent to Participate
Your involvement in the research is entirely voluntary and you have the right to withdraw at any stage without it affecting your rights or my responsibilities. When you have signed the consent form, I will assume that you have agreed to participate and will allow me to use your data in this research.

Confidentiality
The information you provide will be kept strictly anonymous and only my supervisor and I will have access to it. The questionnaire and all information provided will be kept in a locked cabinet for five years, before it is destroyed.

Further Information
This research has been reviewed and given approval by Curtin University of Technology Human Research Ethics Committee. If you would like further information about the study, please feel free to contact me on my mobile at 98343906 or by email: donna.lim@nie.edu.sg.

Alternatively, you can contact my supervisor Professor Barry Fraser at B. Fraser@curtin.edu.au.

I would like to thank you for your involvement in this research and your participant is greatly appreciated.

Curtin
University of Technology

CONSENT FORM FOR STUDENT PARTICIPANTS

- I understand the purpose and the procedures of the study.
- I have been provided with the participant information sheet.
- I understand that my involvement in this study itself may not benefit me.
- I understand that my involvement is voluntary and I can withdraw from it any time without problem.
- I understand that no personal identifying information like my name or address will be used and all that information will be securely stored for 5 years before being destroyed.
- I have been given the opportunity to ask questions.
- I agree to participate in the study outlined to me.

Name : _____

School : _____

Class : _____

Signature : _____ Date : _____

Parent Signature : _____ Date :_____

Curtin University of Technology
School of Science and Mathematics Education Centre

Participant Information Sheet for Parent

My name is Donna and I am currently completing a piece of research for my PhD (Doctor of Philosophy - Science and Mathematics Education) at Curtin University of Technology.

Purpose of Research
I am investigating the classroom learning environment and student attitude towards English in the Singaporean classroom.

Your Child's Role
Your child will be asked to complete a questionnaire. The approximate amount of time that it will take for him/her to answer the questionnaire is approximately 30 minutes. The questionnaire will be given to him/her after his/her year end examinations.

Consent For Your Child's Participation
Your child's involvement in the research is entirely voluntary. Your child has the right to withdraw at any stage without it affecting his/her rights. When you have signed the consent form, I will assume that you have agreed to allow your child to participate and will allow me to use the data in this research.

Confidentiality
The information your child provides will be kept strictly anonymous and only my supervisor and I will have access to it. The questionnaire and all information provided will be kept in a locked cabinet for five years, before it is destroyed.

Further Information
This research has been reviewed and given approval by Curtin University of Technology Human Research Ethics Committee. If you would like further information about the study, please feel free to contact me on my mobile at 98343906 or by email: donna.lim@nie.edu.sg.

Alternatively, you can contact my supervisor Professor Barry Fraser at B. Fraser@curtin.edu.au.

I would like to thank you for your involvement in this research and your participant is greatly appreciated.

Curtin
University of Technology

CONSENT FORM FOR PARENT

- I understand the purpose and procedures of the study.
- I have been provided with the information sheet for Parent.
- I understand that the procedure itself may not benefit my child.
- I understand that my child's involvement is voluntary and he/she can withdraw at any time without problem.
- I understand that no personal identifying information like my child's name and address will be used in any published materials.
- I understand that all information will be securely stored for at least 5 years before a decision is made as to whether it should be destroyed.
- I have been given the opportunity to ask questions about this research.
- I agree to allow my child to participate in the study outlined to me.

I allow my child to participate in the study.

Student's Name : _____

School : _____

Class : _____

Parent's Signature : _____

Date : _____

Curtin University of Technology
School of Science and Mathematics Education Centre

Participant Information Sheet for Teacher Participant

My name is Donna and I am currently completing a piece of research for my PhD (Doctor of Philosophy - Science and Mathematics Education) at Curtin University of Technology.

Purpose of Research
I am investigating the classroom learning environment and student attitude towards English in the Singaporean classroom.

Your Role
I will ask your student to complete a questionnaire which will take him/her approximately 30 minutes to complete. I seek your assistance in giving out and collecting the Student Consent Form as well as the Parent Consent Form for each individual student in your class prior to the administration of the questionnaire. I also seek your assistance in distributing and collecting the questionnaire as well as ensuring that the students under your care are able to complete the questionnaire uninterruptedly.

Consent to Participate
Your involvement in the research is entirely voluntary and you have the right to withdraw at any stage without it affecting your rights or my responsibilities. When you have signed the consent form, I will assume that you have agreed to participate and will allow me to use your data in this research.

Confidentiality
The information provided will be kept strictly anonymous and only my supervisor and I will have access to it. The questionnaire and all information provided will be kept in a locked cabinet for five years, before it is destroyed.

Further Information
This research has been reviewed and given approval by Curtin University of Technology Human Research Ethics Committee. If you would like further information about the study, please feel free to contact me on my mobile at 98343906 or by email: donna.lim@nie.edu.sg.

Alternatively, you can contact my supervisor Professor Barry Fraser at B. Fraser@curtin.edu.au.

I would like to thank you for your involvement in this research and your participant is greatly appreciated.

Curtin
University of Technology

CONSENT FORM FOR TEACHER PARTICPANTS

- I understand the purpose and the procedures of the study.
- I have been provided with the participant information sheet.
- I understand that my involvement in this study itself may not benefit me.
- I understand that my involvement is voluntary and I can withdraw from it any time without problem.
- I understand that no personal identifying information like my name or address will be used and all that information will be securely stored for 5 years before being destroyed.
- I have been given the opportunity to ask questions.
- I agree to participate in the study outlined to me.

Signature : _____

Date : _____