Science and Mathematics Education Centre

Science Classroom Learning Environments in Afghanistan: Assessment, Effects and Determinants

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DECLARATION

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

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

Human Ethics (For projects involving human participation/tissue, etc.) The research presented and reported in this thesis was conducted in accordance with the National Health and Medical Research Council National Statement on Ethical Conduct in Human Research (2007) – updated March 2014. The proposed research study received human research ethics approval from the Curtin University Human Research Ethics Committee, Approval Number #SMEC-17-10.

Signature:

Date: May 2018

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ABSTRACT

Over the past 30 years, the field of classroom learning environments has undergone remarkable expansion and internationalisation. However, in Afghanistan, no study in any subject area or at any educational level has ever adopted a learning environment framework and involved the assessment and investigation of classroom environments. Therefore my study involving the assessment, effects and determinants of science learning environments in Afghanistan makes a unique contribution.

One reason for the very low prevalence of any type of educational research in Afghanistan is the extreme difficulties in gaining access to schools and in travel throughout Afghanistan to collect research data. Therefore, achieving a large sample of 1619 students from 23 schools in two Afghani provinces in my study can be considered a remarkable accomplishment.

Gender inequity in education in Afghanistan is well known, widespread and deeply engrained, with females having less educational opportunities than males. Therefore, in my study, comparable numbers of male and female students were included in the sample and sex was included as an independent variable when investigating students' learning environment perceptions.

My study included seven learning environment scales from the widely-used What Is Happening In this Class? (WIHIC) questionnaire, together with five scales assessing student attitudes to science. One attitude scale, Enjoyment of Science Lessons, was from the Test of Science Related Attitudes (TOSRA) and four scales were from the

Students' Adaptive Learning Engagement in Science (SALES) questionnaire. The names of the seven WIHIC scales are Student Cohesiveness, Teacher Support, Involvement, Task Orientation, Investigation, Cooperation and Equity and the names of the four SALES scales are Learning Goal Orientation, Performance Goal Orientation, Task Value and Self-Regulation. After minor modifications to suit the Afghani context, scales were translated into Dari (one of the two dominant languages in Afghanistan) and then independently back-translated to check the accuracy of the original translation.

My first research question involved the assessment of learning environment and student attitudes. Using factor analysis and internal consistency reliability estimates, analyses of data for the sample of 1619 students supported the validity and reliability of the Dari-language WIHIC, Enjoyment and SALES scales used in my study. The development and validation of a Dari version of widely-applicable learning environment and attitude scales is a major methodological contribution of the present study because it will facilitate future research and practical applications in Afghanistan.

To answer my second research question involving the effects of the learning environment, I used simple correlation and multiple regression analyses to explore associations between seven learning environment scales (WIHIC) and five student attitude scales (Enjoyment and SALES). Past research in other countries was replicated in Afghanistan in that positive and statistically-significant associations were found for 28/35 and simple (bivariate) correlations and 28/35 (multivariate) regression coefficients.

For my third research question involving determinants of learning environment, I employed MANOVA/ANOVAs and effect sizes to explore gender difference and school-location differences (urban/rural) in learning environment and student attitudes. Although sex differences were relatively small in magnitude, they favoured males for every scale and were statistically significant for 9 of the 12 learning environment and attitude scales; this finding is consistent with the widespread gender inequity in education in Afghanistan. For school location differences, urban students had higher scores than rural students on every scale and these differences were statistically significant for 11 out of 12 scales; this pattern is consistent with known differences between urban and rural schools in Afghanistan in terms of resources, facilities and teacher qualifications.

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INTRODUCTION

1.1 CHAPTER INTRODUCTION

Research on classroom learning environments has flourished for decades in many countries (Fraser, 2012), but it has never been conducted in Afghanistan prior to my study. Although the education of girls has a higher rate of return than any other investment in the developing world (Summers, Khan & Sabot, 1992), the enrolment rate for girls in Afghanistan remains low. Therefore, my study included student sex as an independent variable.

1.2 CULTURAL AND EDUCATIONAL CONTEXT IN AFGHANISTAN

In Afghanistan, as in other third-world countries, science and technology education is seen as a means of achieving economic prosperity. Historically education in Afghanistan has been Mosque-based and administered by Mullahs (religious leaders) to teach the Koran and other Islamic texts (Winthrop & Kirk, 2008). Mosque-based education takes place from the age of five or six years and has played a critical role in extending access to education and ensuring the literacy of male children. There were no separate parallel facilities available for females, thus depriving girls of the opportunity to become literate.

Towards the end of the 19th century, secular education was introduced into Afghanistan for the first time. Because of the existence of a weak central state and a

predominantly patriarchal and tribal society, only limited progress was made. In contrast, the 1960s and 1970s involved more vigorous efforts to transform the traditional system of education to a modern schooling system. During the time of King Zahir Shah and President Daud Khan (1973–1978), the number of girls' schools increased dramatically and, by 1980, around 30% of children in Afghanistan went to school, including around 20% of girls (Guimbert, Miwa & Nguyen, 2008).

During the last three decades, Afghanistan has moved from a relatively stable Monarchy to a war-torn society in which power struggles and different socio-political ideologies have significantly impacted on the education system (Guimbert et al., 2008). In third-world countries, science and information technology are perceived as a means of achieving social and political goals. The communist coup in 1978 and subsequent Soviet invasion in 1979 triggered a civil war within Afghanistan. Soviet troops were withdrawn in 1989 and the Najibullah government collapsed in 1992. The ensuing chaos and power imbalance allowed the Taliban to enter Kabul in 1996 and later to take over vast regions of the country. It is widely recognised that the occupation of the Taliban regime caused the final demise of Afghanistan's education system, economy and social network (Guimbert et al., 2008).

During this time, girls were prohibited from public schools and boys usually were educated in Madrasas (Islamic religious schools) in "compliance with religious principles" (Georgescu, 2007, p. 428). Other subjects and topics were almost totally replaced by Islamic education. By 2001, Afghanistan was one of the most illiterate countries in the world (Guimbert et al., 2008).

Reports related to women's education and the enrolment of girls after the military actions following the attack on New York on September 11, 2001 also are not heartening (Alvi-Aziz, 2008; Guimbert et al., 2008). Although enrolments have increased from 1 million to 4 million students over the past five years (Guimbert et al., 2008), it is argued by Alvi-Aziz (2008) that this is a gross exaggeration and that, in 2007, the secondary school enrolment for girls was still only 5%. Although there is no consensus regarding the figures reported by different authors, it is acknowledged that the effect of the Taliban's prohibition of education for girls had, and continues to have, a wide-reaching effect on enrolment numbers for girls, particularly in rural areas of the country (Douki, Ben, Nacef, Zineb & Halbreich, 2007; Farrell &Thorne, 2005; Georgescu et al., 2007).

It would appear that the new-found political stability of Afghanistan is currently threatened by a war-lord like atmosphere - related to the flourishing opium trade that generates income needed by many Afghanis (Farrell & Thorne, 2005) - and by the resurrection of the Taliban movement in some regions. The educational reality in Afghanistan is that there are enormous pressures on the school system, including a shortage of physical access to school, school supplies and qualified teachers (Alvi-Aziz, 2008; Guimbert et al., 2008). The enrolment of girls is hampered by issues of security (risk of kidnapping and rape), household factors (including the need for children to work to help to sustain the family) and community factors (related to tradition).

The introduction of non-government private schools is a new phenomenon in Afghanistan and this trend is rapidly increasing throughout the country. For example,

the establishment of the Muslim Ladies College of Australia Afghanistan (now named Rastagaraan) in Kartiparwan Kabul and Armaghaan Mustaqba in Sarak Chilmetra Taymani Kabul as independent schools is a result of demands for more school facilities.

Students, teachers and educators in Afghanistan are affected by the education policy, school culture and the government bureaucracy. Different provinces have distinct cultures and habits which contribute to the functioning and operation of schools. Also each province has a different dialect and, in some cases, even has a different language, which can have an impact on the school, the school culture, language, knowledge and vocabulary. The education system in Afghanistan is centralised and bureaucratic.

The geographic location of a province, as well as its local culture and tradition, agriculture and socio-economic situation, play an important role in school attendance rates (especially among girls) and the amount and level of education that students receive. Afghanistan is a republic and its population is not accurately known. But the estimated population is over 20 million, of which the majorities are Tajik and Pashtun and the minorities are Uzbek, Noristani, Azara and Turkmen.

The majority of Afghans are Sunni Muslim, but a small minority of Shias are spread throughout the country. The official religion is Sunni, but Shias have a constitutional right to freely practise all of their rituals. The official languages of Afghanistan are Pashto and Dari, with the national anthem being in both languages. Afghanistan is currently one of the poorest countries in the world, with over 80% of its population being illiterate (Guimbert et al., 2008).

In Afghanistan, education and textbooks are free for all citizens from the primary level (aged from 6 years) to the tertiary level, including postgraduate studies. The stages of school education are primary education, lower-secondary education and higher-secondary education. Students attend primary education from six years old, excluding pre-schooling. For the whole 12 years of schooling, the medium of instruction is either Dari or Pashto.

At the lower-primary level, students mainly learn literacy, numeracy and religious subjects whilst, for upper-primary students and in the higher grades, a number of extra science and non-science subjects are introduced for students.

To complete this section on the background context of my study in Afghanistan, my own connection to Afghanistan is now described. I was born in Afghanistan and I completed my primary and secondary education in Afghanistan, before undertaking undergraduate and postgraduate studies at universities in Queensland and Western Australia. I have been employed as a science teacher and as a university lecturer in Afghanistan. Currently, I am employed in an administrative and a teaching role at a university in Afghanistan.

I have founded two secondary schools in Afghanistan and I have been the principal of a Muslim school in Australia. I am a fluent speaker of the two main Afghani languages (namely, Dari and Pashto). The above details of my background illustrate that a strength of my study was that, when I personally administered all questionnaires, I had a deep understanding of the Afghani culture and I could speak the two languages

spoken by the students. When I enrolled in a doctorate at Curtin University, I became interested in the programmatic research being conducted on classroom learning environments and was motivated to embark on the first learning environment study undertaken in Afghanistan.

1.3 BRIEF INTRODUCTION TO FIELD OF LEARNING ENVIRONMENTS

Because my study drew inspiration, guidance and methods from, as well as making a modest contribution to, the field of classroom learning environments, this section briefly overviews that field to provide contextual background for this thesis. A fuller review of learning environment literature is provided in Chapter 2. The importance of the learning environment is described by Fraser (2001, p. 1) in the following way:

> *"Because students spend approximately 20,000 hours in classrooms by the time that they graduate from university, students' reaction to their teaching-learning experiences are of considerable importance. However, educators often rely exclusively on assessing achievement and pay scant attention to the quality of the learning environments. Teachers should not feel that it is a waste of valuable teaching time to put energy into improving their classroom climates because the research convincingly shows that attention to classroom environment is likely to pay off in terms of improving student outcomes."*

In contrast to research methods that rely on outside observers, the most common way of measuring classroom environment involves the perceptions of the learners in the environment. This provides a view of classroom environment through the students' eyes and could pick up subtle data that might be considered unimportant by external observers. Although classroom environment is a subtle concept, literature reviews show that enormous progress has been made in conceptualising, measuring and researching it (Fraser, 2012, 2014).

Numerous classroom environment questionnaires have been developed, validated and used extensively in many countries at various levels of education. In my study, the world's most-widely used learning environment instrument, the What Is Happening In this Class? (WIHIC), was modified, translated and used to assess Afghani students' perceptions of student cohesiveness, teacher support, involvement, investigation, task orientation, cooperation and equity (Aldridge, Fraser & Huang, 1999).

Historically, learning environment research was pioneered in the USA by Herbert Walberg (1969), who developed the Learning Environment Inventory (LEI) for evaluating Harvard Project Physics, and Rudolf Moos (1974), who developed the Classroom Environment Scale (CES) as one of nine questionnaires for assessing different human environments (e.g. hospital wards and prisons). These pioneering efforts later were the catalyst for many and varied research programs around the world reviewed by Fraser (2012).

Many dozens of studies from numerous countries (Fraser, 2014) have convincingly demonstrated that the classroom environment strongly influences student outcomes

(especially achievement and attitudes). Therefore educators should strive to create positive learning environments as a way to improve student outcomes. It seems that "constructive educational climates may be so vitally important that priorities should be drastically rearranged" (Riorden, 1982, p. 310). The effects of the classroom environment on students' attitudinal outcomes were explored in my research.

Classroom environment assessments also have been used as dependent variables in many evaluations of educational programs (e.g. Cohn & Fraser, 2016; Zaragoza & Fraser, 2017) and in studying determinants of the environment. For example, in my study, I investigated student sex and school location (urban/rural) differences in students' perceptions of their classroom environments.

An expanding application of learning environment questionnaires is teacher action research aimed at improving classrooms (Fraser & Aldridge, 2017). Discrepancies between the actual and preferred learning environment as perceived by students have been used to guide numerous successful attempts to improve classrooms (e.g. Henderson & Loh, in press); Rijken, Fraser & Aldridge, 2016).

Literature from the field of learning environments is comprehensively reviewed in Chapter 2.

1.4 RESEARCH QUESTIONS AND SIGNIFICANCE

My three research questions are stated below:

Research Question #1

Assessment: Are questionnaires for assessing Afghani students' perceptions of the learning environments and their attitudes to science valid and reliable?

Research Question #2

Effects: Are aspects of the classroom learning environment associated with student attitudes?

Research Question #3

Determinants: Are there differences in students' perceptions of classroom environment and attitudes according to:

- student sex
- school location (urban, rural)?

The main way in which my study is substantively significant within the field of learning environments is that, despite the extensiveness of learning environment research in so many different countries, this thesis reports the first learning environment study in Afghanistan at any educational level or for any subject area. Therefore, my research contributes to the existing knowledge base about the assessment, effects and determinants of classroom environment in different countries. In this sense, my study in Afghanistan bears similarities with Khine et al.'s (2018)

report of the first learning environment research ever conducted in the country of Myanmar.

The methodological contribution made by my study is that, for the first time, Dari-language versions of learning environment scales (What Is Happening In this Class?, WIHIC) and attitude scales (Students' Adaptive Learning Engagement in Science, SALES) were developed and validated. This opens up the possibility for other educational researchers in Afghanistan to incorporate the assessment of the learning environment and students' attitudes in their research for various purposes.

Practically, my research has some implications for policy makers and science teachers. My study has potential to reveal gender and school-location (urban/rural) differences in learning environments and student attitudes, thereby identifying educational inequalities that need to be rectified. As well, the part of my research involving relationships between students' attitudes to science and the nature of their learning environments could suggest how to improve student attitudes by changing classroom environments.

1.5 OVERVIEW OF OTHER CHAPTERS

This first chapter has introduced my study by giving a brief background of Afghanistan's educational system and its socio-economic structure. Also included in this chapter were my study's aims, rationale, background and significance.

Chapter 2 reviews literature pertinent to my study, including some historical background to the field of learning environments. It describes numerous questionnaires for assessing classroom environment, as well as some lines of past research on learning environments.

Chapter 3 describes my study's research methods, including my sample, data-collection methods, questionnaires and data-analysis methods.

Chapter 4 focuses on reporting analyses and results for my three research questions focusing on, respectively, the assessment, effects and determinants of classroom environment learning environment.

Chapter 5 summarises the thesis, discusses the results, identifies its significance and limitations, and suggests future research directions.

Chapter 2

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter reviews literature relevant to my study involving the assessment, effects and determinants of the learning environment in science classrooms in Afghanistan. In particular, my research involved assessing the learning environment using the What Is Happening In this Class? (WIHIC) questionnaire, which has a history of over two decades in other western and third-world countries. But neither the WIHIC nor any other classroom environment instrument has ever been used in Afghanistan previously. Also my study involved students' attitudes to science. Therefore this literature review encompasses the field of learning environments (including assessment instruments and their applications) and the measurement of students' attitudes.

This chapter reviews literature using the following structure:

2.2 FIELD OF LEARNING ENVIRONMENTS

According to Fraser (1998a, 1998b), academic achievement has been the main focus of attention for most researchers and evaluators in education. But social and psychological aspects of the learning environment of classrooms and schools, which form the basis of this field, have been given less attention. Because of the consistent link between various student outcomes and the classroom learning environment (Fraser, 2012, 2014), it should be considered in any school improvement attempt.

Because students spend up to 15,000 hours in classrooms by the time when they complete high school (Fraser, 2001; Rutter, Maughan, Mortimore, Ouston & Smith, 1979), what happens within these classrooms is likely to influence student outcomes. Despite the importance of student outcomes, they provide an incomplete picture of education (Fraser, 2001). Although the concept of learning environment is subtle, there has been impressive progress in conceptualising it, assessing it and investigating its effects and determinants (Fraser, 2012, 2014). The psychosocial learning environment refers to the tone, ambience or atmosphere and Moos (1979) coined the terms ‘social climate’ and ‘personality of the environment’ to describe the learning environment.

Numerous valid questionnaires have been developed to assess students’ perceptions of aspects of their classroom environments such as: whether a class is student-centred or teacher-centred; whether students are active or passive in class; whether students are undertaking collaborative work; and whether the teacher is approachable and supportive (Fraser, 2007, 2012). Overall, my study was able to draw on the field of learning environments for useful research methods and models.

Because the classroom learning environment affects both the cognitive and affective outcomes of students, the provision of a suitable learning environment is important (Aldridge & Fraser, 2008; Fraser, 2012, 2014). Research on learning environments today builds on Lewin's (1936) seminal recognition that the environment interacts with characteristics of the individual to determine behaviour or outcomes.

Lewin (1936) came up with a formula for human behaviour, $B = f(P, E)$, in which B (human behaviour) is a function of P (the person) and E (the environment). Bandura (1986) acknowledges that social cognitive theory's concept of reciprocal interaction stems from Lewin's concept of human behaviour. Lewin's model was modified by Walberg (1970) to become $L = f(I, A, E)$, in which learning (L) depends on instruction (I), student aptitude (A) and the learning environment (E).

In Murray's (1938) needs–press model, a person's needs arise from pressures from within the individual's environment referred to as environment *press*. Murray distinguished between the environment forces perceived by an outside observer (*alpha press*) and the environment perceived by its inhabitants (*beta press*). Stern, Stein and Bloom (1956) distinguished further between *consensual beta press*, the consensual description of the environment that a particular group develops, and *private beta press*, the private view of the environment that an individual develops.

Research specifically on classroom learning environments took off when the independent research programs of Anderson and Walberg (1968) and Moos (1974) started diverse research programs around the world (Aldridge & Fraser, 2008; Fisher

& Khine 2006; Fraser, 1998b, 2007). Anderson and Walberg (1968) developed the Learning Environment Inventory (LEI) as a source of dependent variables for research and evaluation related to Harvard Project Physics. Moos' studies involved participants' perceptions of nine human environment settings, including prisons and hospitals (Moos & Houts, 1968), and this eventually led to the development of the Classroom Environment Scales (CES) (Moos & Trickett, 1974) for use in school settings.

Moos (1974) also made an enduring contribution by delineating three general dimensions that characterise any human environment: Relationship, Personal Development, and System Maintenance and Change. Table 2.1 provides a description of each of Moos' dimensions. The Relationship dimension focuses on the types and strength of relationships in the environment, whilst the Personal Development dimension focuses on self-enhancement. System Maintenance and Change involves the degree to which the environment is orderly, maintains control and is responsive to change. Moos' (1974) classification of the human environment has provided a theoretical underpinning for the development of many later learning environment instruments (Fraser, 2014).

Table 2.1 Moos' (1974) Three Dimensions of Human Environments

Dimension	Description
Relationship	Assesses the nature and intensity of relationships in the environment
Personal Development	Assesses the degree of opportunities for personal growth and self-enhancement
System Maintenance and Change	Assesses the extent of responsiveness, orderliness, expectation and control in the environment

Based on Moos (1974)

Although previous learning environment research often used questionnaires to assess learning environments, the combining of qualitative and quantitative methods is common today (Aldridge, Fraser & Huang, 1999; Fraser & Tobin, 1991; Tobin & Fraser, 1998). The learning environment has provided a particularly valuable focus in the past evaluations of educational innovations (Maor & Fraser, 1996; Spinner & Fraser, 2005). Because past research has established links between classroom environments and student outcomes (Dorman, Aldridge & Fraser, 2006; Fraser, 1998b, 2012; Goh, Young & Fraser 1995), my study examined relationships between science students' attitudes and the learning environment in schools in Afghanistan.

Fraser (in press) notes three milestones in the development of the field of learning environments. First, an American Educational Research Association (AERA) Special Interest Group (SIG) named SIG Learning Environments was allocated its first program space at the AERA annual meeting in Chicago in 1985. This SIG's 30th anniversary occurred in 2015. Second, *Learning Environments Research: An International Journal* (LERI) was first published in 1998 by Kluwer, then Springer. LERI has now completed 20 successful years. After another 10 years, a book series was initiated entitled *Advances in Learning Environments Research* and published by Sense Publishers.

2.3 LEARNING ENVIRONMENT QUESTIONNAIRES

Fraser 1998a (pp. 7-8) claimed that:

> *"A historical look at the field of learning environment. . . shows that a striking feature is the availability of a variety of economical, valid and widely-applicable questionnaires that have been developed and used for assessing students' perceptions of classroom environment. Few fields in education can boast the existence of such a rich array of validated and robust instruments which have been used in so many research applications."*

Because of the significance of these questionnaires to the learning environments field, the subsections below review the following questionnaires:

2.3.1 Classroom Environment Scale (CES)

As noted earlier, the Classroom Environment Scale (CES) was developed at Stanford University (Moos & Trickett, 1974, 1987) as one of numerous perceptual measures for a variety of human environment, including psychiatric hospitals, university residences, prisons and work milieus (Moos, 1974). The final published version of the CES includes nine scales, namely, Involvement, Affiliation, Teacher Support, Task Orientation, Competition, Order and Organisation, Rule Clarity, Teacher Control and

Innovation. There are 10 items in each scale with a True-False response format. Two sample items are “The teacher takes a personal interest in the students” (Teacher Support) and “There is a clear set of rules for student to follow” (Rule Clarity).

The CES is suited to the secondary-school level, employs a True–False response format and contains nine scales of 10 items each (Moos & Trickett, 1974; Trickett & Moos, 1973). In Australia, Fisher and Fraser (1983) cross-validated the CES and established associations between CES scores and student outcomes (Fraser & Fisher, 1982).

2.3.2 Learning Environment Inventory (LEI)

As noted earlier, the Learning Environment Inventory (LEI), developed as part of the research and evaluation efforts of Harvard Project Physics (Walberg & Anderson, 1968), is historically significant even though it is rarely used in research today. It has 15 scales (Cohesiveness, Friction, Favouritism, Cliqueness, Satisfaction, Apathy, Speed, Difficulty, Competitiveness, Diversity, Formality, Material Environment, Goal Direction, Disorganisation and Democracy) intended for use by senior-high school students.

In earlier research, the LEI was used as a source of independent variables in investigating the effects of classroom environment on student outcomes. For example, for a sample of 3700 students in the USA, Walberg (1969) reported associations between LEI dimensions and students’ interest and achievement in science, as well as their understanding and process skills. Somewhat similar applications of the LEI in

studies of outcome–environment associations were reported for samples in the USA (Lawrenz, 1976; Walberg, 1972) and Israel (Hofstein, Gluzman, Ben-Zvi & Samuel, 1979).

The LEI also has been used as a source of dependent variable in various curriculum evaluation studies (Levin, 1980; Welch & Walberg, 1972) and in studies of determinants of classroom environment, such as class size (Anderson & Walberg, 1972), school location (rural vs. urban; Randhawa & Michayluk, 1975) and grade level (Welch, 1979).

2.3.3 Individualised Classroom Environment Questionnaire (ICEQ)

The ICEQ was one of the first questionnaires to focus on student-centred classrooms (Fraser, 1990; Rentoul & Fraser, 1979). The ICEQ assesses the environment of individualised classes with a total of 50 items in five scales (Personalisation, Participation, Independence, Investigation and Differentiation). Students are asked to choose one of the five frequency alternatives of Almost Never, Seldom, Sometimes, Often, and Very Often. For some items, the scoring direction is reversed.

The ICEQ was used to evaluate the Australian Science Education Project (ASEP, Fraser, 1979) and to investigate associations between student outcomes and the nature of the classroom learning environment (Fraser & Fisher, 1982). The ICEQ also has been used to study: associations between classroom-level and school-level environment (Fraser & Rentoul, 1982); differences between students and teachers in their perceptions of actual and preferred classroom environment (Fraser, 1982);

teachers' attempts to improve their classroom environments (Fraser, Seddon & Eagleson, 1982); and person–environment fit studies of whether students achieve better in their preferred classroom environments (Fraser & Fisher, 1983).

2.3.4 My Class Inventory (MCI)

A simplified version of the LEI, the My Class Inventory (MCI), was developed for use with children aged 8–12 years (Fraser, Anderson & Walberg, 1982; Fisher & Fraser 1981; Fraser & O'Brien, 1985). This questionnaire first was developed for use with primary-school students, but it was found also to be useful for research involving middle-school students who experience reading difficulty. To make the instrument more manageable for younger children, the items were simplified to make them easier to read, the numbers of items and scales were reduced and the number of response alternatives was reduced to a Yes–No format. Goh, Young and Fraser (1995) subsequently used the three responses of Sometimes, Seldom and Most of the Time to provide a more meaningful response format. The final version of the MCI has 35 items within five scales, namely, Friction, Cohesiveness, Difficulty, Satisfaction and Competiveness. Sample items include "Children seem to like the class" (Satisfaction) and "Children are always fighting with each other" (Friction).

The MCI has been used successfully in numerous countries, including the United States (Scott Houston, Fraser & Ledbetter, 2008; Sink & Spencer, 2005), Brunei Darussalam (Majeed, Fraser & Aldridge, 2002) and Singapore (Goh, Young & Fraser, 1995). In Brunei Darussalam, when the MCI was administered on 1565 lower-secondary mathematics students, it displayed satisfactory factorial validity and

reliability (Majeed, Fraser & Aldridge, 2002). Two independent studies in the US, one involving 588 grade 3 to 5 students (Scott Houston, Fraser & Ledbetter, 2008) and the other involving a revised 18-item version used with 2,835 grade 4–6 students in Washington State (Sink & Spencer, 2005), revealed that the MCI had satisfactory psychometric properties.

The first version of the MCI was derived from the LEI (Learning Environment Inventory) with children aged 8–12 years as the target group (Fraser, Anderson & Walberg, 1982). A further modification by Fraser and O'Brien (1985) saw the creation of a 25-item version of the MCI. Differences between the LEI and MCI include: simpler wording of the items to make it more useable with younger children; only five of the LEI's 15 scales in order to make it shorter for younger children; a reduction of the number of response alternatives from four in the LEI to two (Yes–No) in the MCI; and students provide answers on the questionnaire itself rather than on a separate response sheet to minimise errors.

In spite of the LEI being used seldom in contemporary research, the low reading level of the MCI makes it a continuing choice in some recent studies. For example, the MCI was used to evaluate the use of science kits in terms of learning environment criteria for a sample of 588 grade 3–5 students in Texas (Scott Houston, Fraser & Ledbetter, 2008). In Florida, Mink and Fraser (2005) used the MCI, attitude scales and qualitative methods in evaluating the K–5 Project SMILE (Science and Mathematics Integrated with Literature Experiences) among 120 grade 5 mathematics students.

2.3.5 Questionnaire on Teacher Interaction (QTI)

Previous research has indicated that the interaction of the teacher with students can influence student outcomes. The Questionnaire on Teacher Interaction (QTI) was developed in the Netherland in the Dutch language by Wubbels, Creton, Levy and Hooymayers (1993) to evaluate teachers' and students' perceptions of interpersonal teacher behaviour. A theoretical model maps interpersonal behaviour using an *influence* dimension (Submission – Dominance) and a *proximity* dimension (Opposition – Cooperation) (Wubbels & Brekelmans, 2005, 2012; Wubbels & Levy, 1993).

The QTI is based on Leary's (1957) work on the interpersonal diagnosis of personality. The QTI's dimensions are represented in a coordinate system divided into eight equal sectors to form the scales of Leadership, Helping/Friendly, Understanding, Student Responsibility/Freedom, Uncertain, Dissatisfied, Admonishing, and Strict behaviour (Wubbels & Brekelmans, 2012). The response format involves a five-point rating scale ranging from Never to Always.

The QTI has been translated into different languages including Korean, Standard Malay and Indonesian, and cross-validated at different grade levels in the USA (Wubbels & Levy, 1993), Australia (Fisher, Henderson & Fraser, 1995; Henderson, Fisher & Fraser, 2000), Singapore (Goh & Fraser, 1998; Quek, Wong & Fraser, 2005), Korea (Kim, Fisher & Fraser, 2000; Lee, Fraser & Fisher, 2003), Brunei Darussalam (Scott & Fisher, 2004) and Indonesia (Fraser, Aldridge & Soerjaningsih, 2010).

Brekelmans, Wubbels and van Tartwijk (2005) showed interesting developments in teacher interpersonal behaviour across the duration of the teaching career.

2.3.6 Constructivist Learning Environment Survey (CLES)

The Constructivist Learning Environment Survey (CLES) assesses the extent to which a specific classroom's environment is consistent with constructivist epistemology (Taylor, Dawson & Fraser, 1995; Taylor, Fraser & Fisher, 1997). According to constructivists, meaningful learning is an active process of supporting construction (Duffy & Cunningham 1996).

The CLES has six items in each of the five scales of Personal Relevance, Uncertainty, Critical Voice, Student Negotiation and Shared Control. The response format involves a five-point frequency scale of Almost Never, Seldom, Sometimes, Often and Almost Always. The CLES was the first learning environment instrument to arrange its items in blocks, instead of randomly or cyclically, to provide students with contextual cues, thereby improving the reliability of the instrument (Taylor, Fraser & Fisher, 1997). Two sample items are "I learn that science has changed over time" (Uncertainty) and "It's okay for me to express my opinions" (Critical Voice).

The validity and usefulness of the CLES has been reported in numerous studies, including a cross-national study in Taiwan and Australia (Aldridge, Fraser, Taylor & Chen, 2000) involving 1081 Australian and 1879 Taiwanese students. Peiro and Fraser (2009) administered a modified version of the CLES in Spanish and English to 739 K–3 science students in Miami. In addition to validating the CLES with young

children, strong associations were found between learning environment variables and the nature of the classroom environment. Also, Koh and Fraser (2014) used the CLES with 2216 secondary-school students taught by preservice teachers following a mixed-mode delivery model and 991 students in a control group. This study in Singapore supported the efficacy of the mixed-mode delivery, as well as cross-validating the CLES.

Ebo and Fraser (in press) selected three scales from the CLES for inclusion in an evaluation of inquiry-based instruction in high-school science (together with other learning environment and attitude scales). The sample comprised 1396 students in 35 classes in Los Angeles. As well as cross-validating the CLES, the study revealed that inquiry classrooms had more favourable learning environments than non-inquiry classrooms for the scales of Personal Relevance, Critical Voice and Student Negotiation.

2.3.7 Science Laboratory Environment Inventory (SLEI)

An important setting in science education is the science laboratory classroom. The Science Laboratory Environment Inventory (SLEI) was developed to assess the unique dimensions of science laboratory classes (Fraser, Giddings & McRobbie, 1995; Fraser & McRobbie, 1995). This 35-item questionnaire has five scales called Student Cohesiveness, Open-Endedness, Integration, Rule Clarity and Material Environment. Its five-point frequency response scale consists of Almost Never, Seldom, Sometimes, Often and Very Often. The SLEI was field tested and validated simultaneously in six countries (Australia, Israel, USA, England, Canada and Nigeria) with a huge sample

of 5447 students in 269 classes (Fraser, Giddings & McRobbie, 1995). The SLEI also has been used in chemistry classes in Singapore (Wong & Fraser, 1996), high-school biology classes in the USA (Lightburn & Fraser, 2007) and middle-school science classes in Australia (Rogers & Fraser, 2013).

In Korea, Fraser and Lee (2009) used a Korean-language version of the SLEI with 439 students made up of 145 humanities stream students, 99 science-independent stream students and 195 science-oriented stream students. This research cross-validated a Korean version of the SLEI. Students in the science-independent stream perceived their learning environments more favourably than did students in either of the other two streams. The SLEI scale of Integration (measuring integration between theory and practical classes) was found to be a strong predictor of students' attitudes.

2.3.8 What Is Happening In this Class? (WIHIC) Questionnaire

Because the WIHIC was the learning environment questionnaire adopted and translated for my study, it is considered in detail in this section. The WIHIC has 56 items divided equally into the seven scales of Student Cohesiveness, Teacher Support, Involvement, Investigation, Task Orientation, Cooperation and Equity. The WIHIC is the most-frequently used learning environment questionnaire around the world today. According to Dorman, it has achieved "almost bandwagon status" (Dorman, 2008, p. 181).

Dorman (2003, 2008) has reported impressive validation information for the WIHIC. Using confirmatory factor analysis with data from 3980 high-school students from

Canada, the UK and Australia, Dorman (2003) supported the WIHIC's seven-scale structure, which was invariant to grade level, student sex and country. In a second study, (Dorman 2008) used multitrait–multimethod modelling with data from 978 secondary students to provide further support for the construct validity of the WIHIC.

Fraser (2012) tabulated 21 studies from 11 countries that supported the validity of the WIHIC and its usefulness in research applications. Similarly, Khine et al. (2018) provided a tabulation of 24 studies in 12 countries that had cross-validated and used the WIHIC.

Table 2.2, which is an adapted and expanded version of a table in Fraser (in press), lists 22 studies that used the WIHC in 13 countries in 12 languages. Every study in Table 2.2 provided support for the WIHIC's validity and reliability in widely-varied contexts for its original, adapted and/or translated form. The right-hand column of Table 2.2 highlights some of the interesting and useful findings from each of the 22 studies.

Ebo and Fraser (in press) also included several scales from the WIHIC in their evaluation of inquiry-based instruction in high-school science (together with other learning environment and attitude scales) among 1396 students in 35 classes in Los Angeles. As well as cross-validating the WIHIC, the study revealed that inquiry classrooms had more favourable learning environments than non-inquiry classrooms in terms of Student Cohesiveness, Teacher Support and Involvement. Effect sizes were large for Teacher Support (0.93 standard deviations) and Involvement (0.63 standard deviations).

Table 2.2 Selected Findings from 22 Studies Using the WIHIC

Location	References	Sample	Selected Findings
Taiwan & Australia	Aldridge & Fraser (2000); Aldridge, Fraser & Huang (1999)	1879 Taiwanese & 1081 Australian junior-high science students	Validated WIHIC in two languages. Learning environment differences between Taiwan & Australia.
Indonesia & Australia	Fraser, Aldridge & Adolphe (2010)	594 Indonesian and 567 Australian secondary science students	Cross-validated WIHIC in two languages. Differences between countries and sexes.
Singapore	Lim & Fraser (in press)	441 grade 6 English students	WIHIC was cross-validated. Classroom environment varied with student sex and ethnicity.
Singapore	Chionh & Fraser (2009)	2310 grade 10 geography & mathematics students	Validated WIHIC for two school subjects. Differences between school subjects.
Singapore	Goh & Fraser (2016)	485 grade 6 science students	WIHIC was cross-validated. Differences between sexes and between actual and preferred environments.
Jordan	Alzubaidi, Aldridge & Khine (2016)	994 university students of English as a second language	Arabic version of WIHIC was validated. Learning environment related to student motivation and self-regulation.
China	Bi (2015)	1235 grade 7–11 English students	Modified WIHIC was validated. Small sex differences in learning environment perceptions. Weak relationships between classroom environment and oral English.
China	Liu & Fraser (2013)	945 English majors aged 18–20 years	Several WIHIC scales related to English language motivation.
Korea	Baek & Choi (2002)	1012 grade 11 & 12 English students	WIHIC scores varied with school and classroom organisation and correlated with English achievement.
Korea	Kim, Fisher & Fraser (2000)	543 grade 8 science students	Korean WIHIC was validated. Sex differences in learning environment perceptions.
South Africa	Aldridge, Fraser & Ntuli (2009)	1077 grade 4–7 students	Validated WIHIC in IsiZulu language. Preservice teachers in a distance-education program used environment perceptions to improve classroom environments.
UAE	Afari, Aldridge, Fraser & Khine (2013)	352 college mathematics students	Arabic WIHIC was validated. Using mathematics games promoted positive classroom environments. Females perceived environments more favourably.
Myanmar	Khine et al. (2018)	251 first-year university science students	Validated Myanmar version of WIHIC.

			No sex differences in correlations between WIHIC scales.
India	Koul & Fisher (2005)	1021 science students	Cross-validated WIHIC. Learning environment differences between cultural backgrounds.
Greece	Charalampous & Kokkinos (2017)	Groups of 504 and 984 elementary students	Validated a modified Greek language version of WIHIC (G-EWIHIC) for elementary students.
USA	Cohn & Fraser (2016)	1097 grade 7 & 8 science students in New York	Cross-validated WIHIC. Large learning environment differences between users and non-users of Student Response Systems.
USA	Wolf & Fraser (2008)	1434 middle-school science students in New York	Inquiry laboratory activities had more favourable learning environments on some dimensions.
USA	Martin-Dunlop & Fraser (2008)	525 female university science students in California	Large increases in learning environment scores for an innovative course.
USA	Skordi & Fraser (in press)	375 university business statistics students in California	Validated WIHIC for use in university statistics classes. Sex differences in WIHIC scores Relationship between some WIHIC scales and student achievement and enjoyment.
USA	Ebo & Fraser (in press)	1396 high-school science students in 35 classes in Los Angeles	Validated selected scales from WIHIC. Inquiry classrooms had more positive learning environments than non-inquiry classrooms, especially for Teacher Support and Involvement.
USA	Helding & Fraser (2013)	924 grades 8 &10 science students in Florida	Validated WIHIC in English and Spanish. Students of teachers with National Board Certification perceived more favourable learning environments.
USA	Zaragoza & Fraser (2017)	765 grade 5 science students from Florida	Validated a modified version of WIHIC in field-study classrooms. Field-study classes had much more positive environments than traditional classes, especially for students with limited English proficiency.

Footnote: Adapted from Fraser (in press)

In Skordi and Fraser's (in press) study tabulated in Table 2.2, learning environment ideas were applied in one of the first studies worldwide involving university statistics classrooms. The sample consisted of 375 students in 12 introductory statistics classes in a university in Southern California. Not only was the WIHIC cross-validated, but

sex differences in learning environment perceptions were detected and significant relationships were found between the learning environment and students' achievement and attitudes.

For 441 grade 6 English students in Singapore, Lim and Fraser (in press) cross-validated the WIHIC and reported associations between the classroom environment and students' attitudes. As well, students' classroom environment perceptions on the WIHIC varied with the determinants of student sex and ethnicity.

Cohn and Fraser's (2016) study in Table 2.2 involved evaluating student response systems (SRS) among 1097 grade 7 and 8 students in New York. Not only was cross-validation support provided for the WIHIC, but huge differences, ranging from 1.17 to 2.45 standard deviations for various learning environment and outcomes scales, were found between SRS and non-SRS students.

2.3.9 Inclusion of WIHIC Scales in Other Learning Environment Instruments

WIHIC scales often have been chosen for inclusion in later specific-purpose learning environment questionnaires. For example, in order to monitor outcomes-based education in South Africa, Aldridge, Laugksch, Seopa and Fraser (2006) included WIHIC scales in the Outcomes-Based Learning Environment Questionnaire (OBLEQ).

For research and evaluation associated with an innovative new senior-high school, the Technology-Rich Outcomes-Focused Learning Environment Inventory (TROFLEI)

was developed to include all WIHIC scales plus Differentiation from the ICEQ, Computer Usage and Young Adult Ethos (Aldridge, Dorman, Fraser, 2004; Aldridge & Fraser, 2008; Dorman & Fraser, 2009). The use of the TROFLEI with 4 146 grade 8–13 students revealed relationships between students' learning environment perceptions and their attitudes (Dorman & Fraser, 2009). In a study involving 2 317 students, use of the TROFLEI revealed interesting differences between males and females and between students involved in university-entrance examinations and students enrolled in wholly school-assessed subjects (Aldridge & Fraser, 2008). Also, by using the TROFLEI to monitor classroom environments over four years, Aldridge and Fraser (2008) were able to provide support for the effectiveness of the school's educational programs.

The Constructivist-Oriented Learning Environment Scale (COLES) includes all of the WIHIC's scales except Investigation and also includes Differentiation from the ICEQ, Personal Relevance from the CLES, Young Adult Ethos from the TROFLEI and the two new scales of Formative Assessment and Assessment Criteria (Bell & Aldridge, 2014; Aldridge, Fraser, Bell & Dorman, 2012). The COLES was validated with 2043 grades 11 and 12 students in 147 classes in Australia (Aldridge et al., 2012).

The How Chemistry Class is Working (HCCW) questionnaire in the Greek language includes selected WIHIC scales and it was used to investigate differences between Greek and Cypriot students in their classroom environment perceptions (Giallousi, Gialamas, Spyrellis & Plavlatou, 2010). Charalampous and Kokkinos (2017) reported a particularly thorough attempt to develop and validate a new elementary-school version of the WIHIC (G-EWIHIC) in the Greek language.

2.4 Research Using Learning Environment Questionnaire

Reviews of classroom environment research (Fraser, 2007, 2012) have delineated numerous lines of past research such as: identifying differences in perceptions of the classroom environment between students and their teachers (Fisher & Fraser, 1983); identifying exemplary teachers (Waldrip, Fisher & Dorman, 2009); and guiding teachers' decisions about implementing strategies to change their classroom environments (Aldridge, Fraser, Bell & Dorman, 2012). Determinants of the classroom environment have also been identified, including: the socio-cultural beliefs of students (Jegede, Fraser & Okebukola, 1994); whether students in Korea were enrolled in subjects that were science or humanities oriented (Lee, Fraser, & Fisher, 2003); and gender differences (Chionh & Fraser, 2009; Quek, Wong & Fraser, 2005). Large cross-national studies have been carried out for the purpose of gaining new insights into areas such as teaching methods and student attitudes that might be overlooked within one culture (Aldridge, Fraser & Huang, 1999; Aldridge, Fraser, Taylor & Chen, 2000; Fraser, Aldridge & Adolphe, 2010).

As well, classroom learning environment assessments have been used in the work of school psychologists (Burden & Fraser, 1993; Sink & Spencer, 2005). Research on learning environments has been assisted by the availability of short-form questionnaires (Fraser & Fisher, 1983a) and versions that assess preferred classroom environment (Byrne, Hattie & Fraser, 1986) as well as the actual environment.

In the subsections below, brief reviews are provided of studies that employed learning environment assessments in (1) investigating the effects of the learning environment (outcome–environment associations) (Section 2.4.1), (2) investigating determinants of learning environment, including the evaluation of educational innovations (Section 2.4.2), teacher action research aimed at improving classrooms (Section 2.4.3) and cross-national studies (Section 2.4.4).

2.4.1 Effects of Learning Environment: Associations between Classroom Environment and Student Outcomes

Because my study involved exploration of associations between the learning environment and students' attitudes, past research on outcome–environment relationships is reviewed here. Fraser (1994) tabulated 40 past studies which replicated associations between student outcomes and the learning environment for various cognitive and affective outcomes, classroom environment instruments and samples ranging across countries and grade levels. Further studies into outcome–environment associations were reviewed by Fraser (2012, 2014).

Using the SLEI, associations between classroom environment and cognitive and affective outcomes were found for high-school chemistry classes in Australia (Fraser & McRobbie, 1995; McRobbie & Fraser, 1993), as well as senior chemistry classes in Singapore (Wong & Fraser, 1996).

Teh and Fraser (1995) conducted a study in Singapore using high-school geography students in computer-assisted instruction classrooms and found associations between classroom environment, achievement and attitudes. Fraser and Butts (1982) reported

links between the classroom environment and science students' attitudes. Associations were found between student outcomes and perceived patterns of teacher–student interaction using the Questionnaire on Teacher Interaction (QTI) among primary-school mathematics students in Singapore (Goh & Fraser, 2000).

A meta-analysis of relationships between student outcomes and learning environment factors conducted by Haertel, Walberg and Haertel (1981) involved 734 correlations from 12 studies involving 17 805 students in 823 classes. One noteworthy finding was that better student achievement occurred in classes with greater cohesiveness, satisfaction and goal orientation and less disorganisation and friction.

Walberg (1981) proposed a nine-factor model of educational productivity in which the psychosocial learning environment is one determinant of student outcomes. When this model was tested via secondary analysis of National Assessment of Educational Progress data, classroom/school environment emerged as a strong independent predictor of both student achievement and student attitudes when numerous other factors in the model were controlled (Fraser, Welch & Walberg, 1986; Walberg, Fraser & Welch, 1986).

2.4.2 Determinants of Learning Environment (Including Evaluation of Educational Innovations)

Because my study involved investigating two determinants of classroom environment in Afghanistan (namely, student sex and whether schools were located in rural or urban areas), this subsection is devoted to briefly reviewing past research on determinants. For example, in early research with the LEI, the classroom environment was reported to vary with grade level (Welch, 1979) and class size (Anderson & Walberg, 1972).

In a study of science practical work in South Australia, Rogers and Fraser (2013) reported that the classroom environment was perceived differently by male and female students and that it also varied with the frequency of practical work. In Singapore, Goh, Fraser and Koul (2018) reported grade-level and sex differences in learning environment perceptions among a sample of 1023 grade 3–5 science students. Differences in classroom environment perceptions have been reported between delinquent and normal students in Japan (Hirata & Sako, 1998), between gifted and non-gifted students in Singapore (Quek, Wong & Fraser, 2005) and between students in different academic streams (Fraser & Lee, 2009).

Although very little past learning environment research has involved school location (rural/urban) as a determinant, as in my study, Randhawa and Michayluk (1975) provided a well-designed study of rural/urban differences in classroom learning environments. Therefore their study provided useful guidance for my research.

Numerous past studies have involved student sex as a determinant of classroom environment perceptions (as in my study). In Singapore, Lim and Fraser (in press) reported sex differences in WIHIC perceptions for 441 grade 6 English students. In the USA, Skordi and Fraser (in press) reported sex differences in classroom environment for university statistics students. Ogbuehi and Fraser (2007) reported that, for a sample of 661 middle-school mathematics students in Los Angeles, females perceived higher levels of Student Negotiation and Task Orientation than did males. Similarly, Taylor and Fraser (2013) found that female mathematics students in California had more positive classroom environment perceptions. Statistically-significant but small sex differences in classroom environment perceptions (with

females holding more positive perceptions) were reported for science students in numerous countries by Fraser and McRobbie (1995) and for geography and mathematics students in Singapore by Chionh and Fraser (2009).

Most past research with learning environment characteristics as dependent variables has involved a variety of innovative educational programs or instructional methods methods as the independent variable. Walberg's historic evaluation of Harvard Project Physics revealed that the new and the traditional physics curriculum could be distinguished in terms of students' classroom environment perceptions (using the Learning Environment Inventory) when a range of student outcome measures showed little differentiation (Welch & Walberg, 1972). Subsequently, learning environment dimensions have continued to be used as criteria of effectiveness in evaluating teacher professional development (Nix, Fraser & Ledbetter, 2005), field study centres (Zaragoza & Fraser, 2017), National Board certification of teachers (Helding & Fraser, 2013), inclusion of games in mathematics teaching (Afari, Aldridge, Fraser & Khine, 2013), computer-assisted learning (Teh & Fraser, 1995), use of reality pedagogy in science teaching (Sirrakos & Fraser, 2017), the implementation of student response systems (Cohn & Fraser, 2016) and 'flipped' classrooms (Strayer, 2012).

Ebo and Fraser (in press) evaluated inquiry-based instruction with a sample of 1396 high-school science students in California. Relative to a non-inquiry group, students in inquiry classrooms had more positive classroom environment perceptions on six scales, with these differences being especially large for teacher support (0.93 standard deviations) and involvement (0.63 standard deviations).

When Afari et al. (2013) involved 352 students taking college-level mathematics classes in the United Arab Emirates in evaluating the use of games, students exposed to in-class mathematical games perceived a more positive learning environment. When an innovative science course for 525 female prospective elementary school teachers in Southern California was evaluated by Martin-Dunlop and Fraser (2008), very large differences (of over 1.5 standard deviations) were found between students' perceptions of the learning environment of the innovative course and their previous courses. When Lightburn and Fraser (2007) used the SLEI with 761 American high-school students in an evaluation of the effectiveness of using anthropometric activities, the anthropometry group had significantly higher scores on some SLEI and attitude scales than a comparison group.

An evaluation of a teacher professional development program in Texas involved 445 students in 25 classes using an innovative form of the CLES which had a side-by-side response format for students to provide their perceptions of THIS classroom and OTHER classroom. Students of teachers who had experienced the professional development (THIS classroom) perceived higher levels of Personal Relevance and Uncertainty relative to the comparison classes (OTHER classroom) (Nix, Fraser & Ledbetter, 2005).

2.4.3 Teacher as Researcher: Improving Classroom Environments

Teachers can follow a simple five-step model for improving their classroom environments based on feedback from students about their perceptions of classroom learning environment (Fraser, 1981a). Fraser and Aldridge (2017) reviewed the

sporadic application of this approach and its evolution into more sophisticated methods for scoring questionnaires and graphically depicting feedback. For example, in South Africa, Aldridge, Fraser and Sebela (2004) reported how teachers used the CLES with 1864 grade 4–9 students in attempts to improve their classrooms. In Australia, Aldridge, Fraser, Bell and Dorman (2012) reported teachers' use of the 11 scales from the COLES in successful attempts to improve classroom environments.

Aldridge and Fraser (2008) reported some case studies of how teachers at a new senior-high school used the TROFLEI in attempts to improve their classroom environments, while Fraser and Aldridge (2017) reported a detailed case study of one teacher's attempt to improve her classroom environment using the COLES. Henderson and Loh (in press) reported the use of students' learning environment perceptions on the COLES to guide teachers' professional learning at one school. In this mixed-method study, 25 teachers and 500 students each year highly valued this kind of feedback in supporting teacher professional learning. A recent whole-school principal-led attempt at improving a school's classroom environments, involving 2673 grade 8–12 students and 171 teachers, revealed improvements in learning environment and students' self-efficacy (Rijken, Fraser & Aldridge, 2016).

2.4.4 Cross-National Studies

In Aldridge Fraser and Huang's (1999) and Aldridge and Fraser's (2000) cross-national study, six Australian and seven Taiwanese researchers cooperated on research on learning environments. The WIHIC was administrated to 50 junior high-school science classes in each of Taiwan (1879 students) and Australia (1081students). After

an English version of the questionnaire was translated into Chinese, this Chinese version was back translated into English by independent team members who were not involved in the original translation. Qualitative data, involving interviews with teachers and students and classroom observations, were collected to complement the quantitative information and to clarify reasons for patterns and differences between mean scores in the two countries.

The largest differences between the two countries arose for Involvement and Equity, with Taiwanese students perceiving these constructs less positively than Australian students. Questionnaire responses were used to guide the collection of qualitative data and to form an interview schedule that was used to help to explain some of the differences in the questionnaire means between these two countries with cultural differences (Aldridge & Fraser, 2000). Similar cross-national research involving the use of the CLES in Taiwan and Australia was reported by Aldridge, Fraser, Taylor and Chen (2000).

A cross-national study in Indonesia and Australia was reported by Fraser, Aldridge and Adolphe (2010). A modified version of the WIHIC was used in both the English and Indonesian languages with 567 science students from 18 classes in Australia and 594 science students from 18 classes in Indonesia. Not only was the WIHIC cross-validated in both countries, but differences in learning environment were found between countries and between sexes. Additionally, positive associations were found between students' attitudes to science and their classroom environment perceptions.

2.5 ASSESSMENT OF STUDENTS' ATTITUDES

Because my study involved investigating the effect of classroom environment on students' attitudes, Section 2.5 reviews literature on assessing attitudes. Mueller (1986) noted that attitudes cannot be directly observed and that, therefore, their existence must be inferred from their consequences. Kerlinger (1986) defined an attitude as "…an organized predisposition to think, feel, perceive, and behave toward a referent or cognitive object" (p. 453), whereas Aiken (2000) defined attitude as a positive or negative emotional disposition. Baron and Byrne (1977) defined attitude as an individually-attributed belief, emotion and behavioural tendency towards an object.

Thurston (1928) defined attitudes as the sum total of one's feelings and inclination, fears, threats, bias, ideas, prejudices, preconceived notions or convictions about a specific topic. Cotterall (1995) considers that a student's attitude to learning influences his/her learning behaviour and learning outcomes. According to Cotterall (1995), attitudinal behaviour is learned, can be modified and depends on self-regulation, which can motivate students to practise skills (Zimmerman, 2000).

Specifically in science education, there has been a long history of interest in the measurement and investigation of attitudes (see reviews by Kind, Jones & Barmby, 2007; Saleh & Khine, 2011; Tytler & Osborne, 2012). However, numerous problems in the assessment of attitudes to science are well-known (Osborne, Simons & Collins, 2003).

Attitudes can be assessed using qualitative and quantitative methods. Common methods for the quantitative assessment of attitudes are the Guttman scale, semantic differential scale and Thurstone scale (Tavşancil, 2006). Likert's (1932) technique for measuring attitudes involves respondents in specifying their level of agreement or disagreement to a set of statements. The SALES attitude scales used in my study use a Likert-type response scale.

2.5.1 Enjoyment of Science Lessons Scale from TOSRA

My study made use of the Enjoyment of Science Lessons scale from the Test of Science-Related Attitudes (TOSRA, Fraser, 1981b). Noting three potential problems with several existing instruments frequently used to assess attitudes towards science (low statistical reliability, a lack of economy of items, and the combination of distinct attitudes concepts into a single scale which creates a mixture of variables), Fraser (1978, 1981b) developed the TOSRA to overcome these shortcomings. TOSRA measures seven categories of attitudes towards science among secondary-school students: Social Implications of Science, Attitude to Scientific Inquiry, Adoption of Scientific Attitudes, Enjoyment of Science Lesson, Leisure Interest in Science, Career Interest in Science, and Normality of Scientists. However, only the Enjoyment scale was selected as being centrally relevant in my research.

Most or all of TOSRA's scales have been used in investigations of associations between learning environment dimensions and students' attitudes in Australia (Fraser & Butts, 1982; Fraser & Fisher, 1982), Singapore (Wong & Fraser, 1996), Korea

(Fraser & Lee, 2015), Indonesia (Fraser, Aldridge & Adolphe, 2010) and China (Liu & Fraser, 2013).

Although the TOSRA originally was designed to assess students' attitudes to science, it subsequently has been successfully modified and cross-validated as a measure of attitudes towards mathematics (TOMRA, Ogbuehi & Fraser, 2007), geography (ToGRA, Walker, 2006), chemistry (TOCRA, Wong & Fraser, 1996), Spanish (Test of Spanish Related Attitudes, Adamski, Fraser & Peiro, 2013) and English (Liu & Fraser, 2013). Versions of TOSRA have been translated into Indonesian (Fraser, Aldridge & Adolphe, 2010), Korean (Fraser & Lee, 2015) and Chinese (Liu and Fraser, 2013).

2.5.2 Students' Adaptive Learning Engagement in Science (SALES) Questionnaire

In addition to TOSRA's Enjoyment of Science Lessons scale, my study made use of four of the five scales in a preliminary version of the Students' Adaptive Learning Engagement in Science (SALES) questionnaire developed by Velayutham (2010, personal communication). This preliminary version of the SALES (which was the only version available at the commencement of my study) contained five scales called Learning Goal Orientation, Performance Goal Orientation, Task Value, Self-Regulation and Self-Efficacy. However the later published version of the SALES was reduced to four scales by removing Performance Goal Orientation (Velayutham, Aldridge & Fraser, 2011). In my study, for reasons of economy of administration time and my decision to include the Enjoyment of Science Lessons scale in my research (see Section 2.5.1), I removed one of the five scales in the SALES' preliminary

version. Based on feedback from science teachers in Afghanistan, I decided to exclude Self-Efficacy from my study. Each of the five constructs in the preliminary version of the SALES are considered briefly below.

Because students' successful learning engagement depends upon their level of motivation (Kaplan, Lichtinger & Gorodetsky, 2009; Zimmerman, 2008), Velayutham et al. (2011) identified four factors that contribute to students' motivated learning engagement and developed the SALES to measure those four factors. Three aspects of motivation that are consistently linked with student adaptive motivational beliefs are learning goal orientation, task value and self-efficacy (Zimmerman, 2002) and each of these constructs is included as a scale in the SALES. The fourth important construct included in the SALES is self-regulation (Pintrich, 2000). Achievement goal theory is an important theory of student motivation for understanding and improving students' adaptive learning engagement (Kaplan & Maehr, 2007). There are two types of goal orientation, namely, learning goal orientation and performance goal orientation (Ames, 1992).

Learning Goal Orientation is important for understanding students' engagement in tasks (Pintrich, 2000) and because of its focuses on learning, understanding and mastering tasks (Ames, 1992). Learning goal orientation has been found to influence students' achievement (Kaplan & Maehr, 1999, 2007) and attitudes to science (Tuan, Chin & Shieh, 2005).

Performance Goal Orientation focuses on the degree of importance that learners place on demonstrating their competence, especially to other people. Based on research

reviewed by Urdan and Schoenfelder (2006), having a strong performance goal orientation can detract from students' motivation and achievement.

Wolters and Rosenthal's (2000) idea of *Task Value* is that, if students believe that their learning activity is important, interesting and useful, they try harder and persist longer. Schunk and Zimmerman (2007) agree that even students with low self-efficacy are likely to sustain their efforts if they value the learning activity. Expectancy-value theory recognises the centrality of task value beliefs in students' motivation (Pintrich & De Groot, 1990). Task value has been found to be associated with cognitive engagement (Pintrich & De Groot, 1990; Wolters, Yu & Pintrich, 1996) and various outcomes in science (Tuan et al., 2005).

Self-Regulation is "the degree to which students metacognitively, motivationally and behaviourally participate in the learning process" (Velayutham et al., 2011, p. 2164). Self-regulated learners manage their own motivation and cognitive processes in order to achieve educational goals (Boekaerts & Cascallar, 2006). Zimmerman (2008) identified the three core requirements of the self-regulated learner as being personal initiative, perseverance and adaptive skills. Pintrich (2003) reported that students with higher self-regulation skills were more academically motivated. An example of a questionnaire for assessing student self-regulated learning among college students is the Learning and Study Strategies Inventory (LASSI, Weinstein, Schulte & Palmer, 1987).

In Bandura's (1977) social cognitive theory, *Self-Efficacy* is a measure of a person's belief in his/her ability to complete tasks and achieve goals. That is, students are more

likely to be motivated to learn and make more effort if they believe that they can achieve the desired outcomes (i.e. have high efficacy) (Bandura, 1986; Schunk & Pajeres, 2005). Researchers have reported links between self-efficacy and students' achievement (Andrew, 1998), future performance (Britner & Pajares, 2006) and career choices (Gwilliam & Betz, 2001).

The original validation of the final four-scale version of SALES by Velayutham et al. (2011) was particularly thorough, involved an Australian sample of 1360 grade 8–10 science students in 78 classes, and was based on Trochim and Donnelly's (2006) framework. This framework covers content validity (constructs are well defined theoretically), face validity (items clearly reflect the theoretical constructs), convergent validity (items assessing the same construct are highly intercorrelated), discriminant validity (items assessing different constructs have low intercorrelations), concurrent validity (questionnaire scores distinguish between groups that are theoretically distinct) and predictive validity (questionnaire scores predict constructs that they should theoretically predict). In particular, factor analysis confirmed the a priori four-factor structure of the SALES, with these four factors explaining 63.2% of the variance. The Cronbach alpha reliability coefficient for each scale was above 0.90. The SALES' predictive validity was indicated by significant correlations with student achievement ranging from 0.43 to 0.69 for different scales.

The final version of the SALES was cross-validated in South Australia with a sample of 431 middle-school science students (Rogers & Fraser, 2013). Factor analysis confirmed the SALES' four-scale structure with 66.3% of variance accounted for by the four scales. Scale alpha reliability values ranged from 0.78 to 0.86. When SALES

scales were used as dependent variables, it was found that Self-Efficacy varied significantly with student sex and that both Task Value and Self-Regulation varied with frequency of science laboratory work. Also, associations were found between the classroom learning environment (as assessed with the Science Laboratory Environment Inventory, SLEI) and each SALES scale (Rogers & Fraser, 2013).

Also the SALES' final version was cross-validated in South Florida with a sample of 495 grade 6–8 students in 31 classes in 10 schools (Koren & Fraser, 2013). Factor analysis supported the structure of the SALES' four scales, which accounted for 59.7% of the variance. The alpha reliabilities of SALES scales ranged from 0.89 to 0.91. Self-Regulation scores were significantly different for gifted and non-gifted students and there were significant associations between all SALES scales and the classroom environment as assessed using the What Is Happening In this Class? (WIHIC).

Recently, Pasha-Zaidi et al. (in press) used three SALES scales (namely, Task Value, Self-Regulation and Self-Efficacy) with a sample of 327 college students from three countries (the USA, the UAE and Turkey). This study cross-validated these three SALES scales and established relationships (which varied somewhat between countries) among SALES scales and between SALES scales and the construct of 'grit'.

2.6 SUMMARY

The purpose of Chapter 2 was to review literature pertinent to my study into the assessment, effects and determinants of classroom learning environments in Afghanistan.

Some historical perspectives were provided in Section 2.2 on the field of learning environments. It was noted that work specifically in education drew inspiration from earlier work in business settings by Lewin (1936) and Murray (1938). In Lewin's theory, human behaviour is a function of the interaction between personal characteristics and the environment. In Murray's needs-press model, personal needs arise from pressures (or press) within the individual's environment.

Specifically in education, the foundations of the field of learning environments were laid in the USA by Walberg (1969), who developed the Learning Environment Inventory (LEI) for research on Harvard Project Physics, and Moos (1974) who developed the Classroom Environment Scale (CES) as one of nine questionnaires for assessing different human environments. A noteworthy contribution made by Moos was the identification of three overarching dimensions that characterise all human environments: relationship; personal development; and system maintenance and change.

Three milestones in the evolution of the field of learning environments were identified in Section 2.2 as being: the formation of the American Educational Research Association's Special Interest Group on Learning Environments (SIG LE) in the mid-1980s; the initiation in 1998 of Springer's *Learning Environments Research: An International Journal*; and the arrival in 2008 of Sense Publishers' book series entitled *Advances in Learning Environments Research.*

Because numerous economical and extensively-validated questionnaires have featured prominently in learning environment research, Section 2.3 was devoted to reviewing eight historically-important or currently-used instruments. The questionnaire reviewed in Sections 2.3.1 to 2.3.7 were the Classroom Environment Scale (CES), Learning Environment Inventory (LEI), Individualised Classroom Environment Questionnaire (ICEQ), My Class Inventory (MCI), Questionnaire on Teacher Interaction (QTI), Constructivist Learning Environment Survey (CLES) and Science Laboratory Environment Survey (SLEI). Because the questionnaire used in my study was the What Is Happening In this Class? (WIHIC), this questionnaire was reviewed in more detail in Section 2.3.8. Finally, in Section 2.3.9, consideration was given to several questionnaires which include most or all WIHIC scales. In particular, Table 2.2 was assembled to provide an overview of 21 studies from 11 countries that had cross-validated the WIHIC and used it for various research purposes.

Section 2.4 was devoted to reviewing past research involving learning environment questionnaires. In Section 2.4.1, a review was provided of studies of the effects of learning environment (i.e. associations between classroom environment and student outcomes). This is similar to one of my research questions which involved relationships between students' attitudes and the learning environment. Section 2.4.2 also was relevant to my study's aim of investigating some determinants of classroom environment (namely, student sex and school location in my research). In reviewing past studies in which learning environment dimensions were employed as dependent variables, it was noted that the most popular application in prior research was in the evaluation of educational programs or innovations. The other applications of learning environment questionnaires reviewed were teacher-researcher attempts to improve classroom environments (Section 2.4.3) and cross-national studies (Section 2.4.4).

Because my study also involved students' attitudes to science, Section 2.5 reviewed various definitions of 'attitude', ways of assessing attitudes, and the longstanding interest among researchers in attitudes to science. In Section 2.5.1, consideration was given to the widely-used Test of Science Related Attitudes (Fraser 1981b) because one of its seven scales (namely, Enjoyment of Science Lessons) was used in my research.

Finally, Section 2.5.2 reviewed literature related to the Students' Adaptive Learning Engagement in Science (SALES) questionnaire because its four scales also were translated and used in my study. The SALES was developed by Velayuthan, Aldridge and Fraser (2011) to assess four constructs relevant for student engagement and motivation in science learning – learning goal orientation, task value, self-efficacy and self-regulation.

Chapter 3

RESEARCH METHODS

3.1 INTRODUCTION

Major thrusts of this pioneering study of science classroom environments in Afghanistan were the validation of Dari-language learning environment scales and exploration of associations between student attitudes and the learning environment. For many years in Afghanistan, females have been excluded from the education system and, since their return to the education system in 2002, females have faced a problems associated with their long absence and social exclusion (Moghadam, 2002). Therefore, in the present study, I also investigated student sex as a determinant of Afghani students' perceptions of the learning environment and their attitudes towards learning science. As well, school location (urban, rural) was included in my research as another determinant of classroom environment and student attitudes.

This chapter provides information about the research methods used in the present study under the following headings:

- Research Questions (Section 3.2)
- Sample (Section 3.3)
- Instruments for Data Collection (Section 3.4)
- Data Collection (Section 3.5)
- Data Analysis (Section 3.6)
- Ethical Considerations (Section 3.7)

- Summary of Chapter (Section 3.8).

3.2 RESEARCH QUESTIONS

The research questions were introduced in Chapter 1 and are reiterated here:

Research Question #1

Assessment: Are questionnaires for assessing Afghani students' perceptions of the learning environments and their attitudes to science valid and reliable?

Research Question #2

Effects: Are aspects of the classroom learning environment associated with student attitudes?

Research Question #3

Determinants: Are there differences in students' perceptions of classroom environment and attitudes according to:

- student sex
- school location (urban, rural)?

3.3 SAMPLE

The sample for the main administration of the questionnaires involved 1619 students from 23 government and private schools in two provinces of Afghanistan. The

subsections below describe how the sample and how it was selected (Sections 3.3.1 to 3.3.5).

Schools in Afghanistan are widely dispersed. As a result, there are major logistical problems in obtaining data as explained later. Sampling of representative characteristics of the wider population, as Cohen, Manion and Morrison (2000) have discussed, was considered. But, because of difficulties in obtaining a sample, convenience also needed to be taken into account.

3.3.1 Country and Provinces

The sample for the present study was selected from Afghanistan because, firstly, it is the country from where I come and, secondly, I speak the two main languages of Dari and Pashtu which are the formal means of communication in Afghanistan. The sample was drawn from two provinces, the capital Kabul and another province, Parwan. The reason for selecting those two provinces were, first, important considerations of safety and stability and, second, selecting schools from these provinces was likely to increase the generalisability of the results of the study. The selection of schools from two different provinces also ensured a range of social and ethnic groups. My familiarity with and knowledge of people and places enhanced students' and teachers' willingness to participate in the research.

3.3.2 Districts and Schools

To increase variability within the sample, I included schools from five districts of each province. The selection of the districts was based on convenience to ensure that the distances that I was required to travel were reduced and made more manageable.

A range of schools was selected across the provinces and districts based on several considerations. First, the size of the school was considered to ensure that a range of both large and small schools was included. Second, all schools were required to be within reasonable proximity to the capital of the provinces (to enable access in a reasonably convenient and timely manner). Third, I only chose schools that were at least seven years old in order to avoid schools which were not well established. Finally, only those schools that had a permanent principal for at least three years were selected, in order to ensure teachers and students were reasonably familiar with the head of school.

In Afghanistan, the average socioeconomic status of the parents whose children attend a particular school is neither defined by any scale nor officially recorded. However, a geographically-close group of schools was selected to the best of my ability to be representative of the different schools in the wider population. The close proximity of the chosen schools to each other also ensured that the amount of time and the cost involved were both minimised during the distribution and administration of the questionnaires and any other aspects of the study.

3.3.3 Grade Levels

Although numerous variables were controlled by involving years 10, 11 and 12 science students, the ages of the students varied widely. Some students in year 10 were older than some year 12 students. Teachers seemed to know the history of their students and most were helpful in facilitating the researcher.

3.3.4 Sample of Students

A purposeful sample of 23 schools was used to ensure that the sample was representative sample in terms of socioeconomic background. Schools were selected from the Kabul and Parwan provinces to obtain a wide range of students in terms of varying cultures. It was considered important to collect data from both government and private schools. All high schools in Afghanistan are single-sex. Therefore, to ensure that both male and female students were represented, male and female government schools, as well as male and female private schools, were selected.

Sample sizes are provided in Table 1. From the 16 private schools, 973 students (298 males and 675 females) responded to the questionnaires and, from the seven government schools, 646 students (351 males and 295 females) from seven schools responded to the questionnaires. 1261 students were from Kabul and 358 were from Parwan. 718 students attended urban schools and 901 students attended rural schools. Criteria for school selection were size (large schools with high student numbers) and ease of access in terms of obtaining permission to administer the questionnaires and close proximity to central towns and cities.

Table 3.1 Sample Sizes for Male and Female Students from Two School Types and Two Provinces

School Type & Province	Number of Schools			Number of Students		
	Males	Females	Total	Males	Females	Total
Type of School						
Government	4	3	7	351	295	646
Private	8	8	16	298	675	973
	12	11	23	649	970	1619
Province						
Kabul	9	9	18	501	760	1261
Parwan	3	2	5	148	210	358
	12	11	23	649	970	1619

Schools were chosen to provide a spread of geographical locations (i.e rural and urban). Because the student population in Afghanistan is widely dispersed, random sampling had administrative and security problems. For Kabul and the province of Parwan, schools could be classified in terms of whether they were small, large, urban or rural.

There was no need to categorise schools according to being single-sex or coeducational because there is no coeducation in secondary schools in Afghanistan. Coeducation only exists in primary schools from grade 1 to grade 6. Because of religious restrictions, the segregation of girls and boys is practised from the age of puberty, commencing from grade 7 which is the beginning of high school. Therefore all secondary schools in Afghanistan are single sex.

3.4 INSTRUMENTS FOR DATA COLLECTION

The most common means of measuring the learning environment and student attitudes has been through the eyes of the participants (Fraser, 2012). The two instruments used in this study to collect data were the What Is Happening In this Class? (WIHIC) to assess students' perceptions of their classroom learning environments (described in

Section 3.4.1) and the Students' Adaptive Learning Engagement in Science Classes (SALES) to assess students' attitudes (described in Section 3.4.3). Additionally, an attitude scale was used to assess students' enjoyment of the science lessons (Section 3.4.2). All scales originally had been developed in Western countries and never been used in Afghanistan prior to this research.

3.4.1 What Is Happening In this Class? (WIHIC)

The WIHIC was developed to address contemporary educational concerns. It includes scales which focus on concerns such as equity and constructivism (Aldridge et al., 1999; Dorman, 2008). The WIHIC combines modified versions of salient scales from different questionnaires. There are two version of WIHIC, namely, the class form (which examines students' perceptions of the whole class) and the personal form (which assesses a student's personal perceptions of his/her part in a classroom). The personal form was used in my study. The WIHIC's original form (Fraser, Fisher & McRobbie (1996) had 90 items, but later it was modified to include 56 items in seven scales. The WIHIC was initially designed for high school science classrooms (Aldridge et al., 1999).

In comparison with all other questionnaires developed in the area of learning environments, the WIHIC is the most popular and most-frequently used instrument in many countries around the world (Dorman, 2008). The seven dimensions in the WIHIC and a description of each are summarised in Table 3.2. Each of the seven scales (dimensions) includes eight items, resulting in a total of 56 items. The questionnaire contains statements relating to the occurrence of various practices that take place in a

given class. Students respond using a frequency scale of Almost Never, Seldom, Sometimes, Often and Almost Always (scored 1, 2, 3, 4 and 5, resoectively). Appendix A contains an English-language version of the WIHIC, whereas Appendix B contains the translated Dari-language version of the WIHIC used in my study.

Table 3.2 Dimensions Assessed by the WIHIC Questionnaire

Dimension	Description
Student Cohesiveness	Extent to which students help and support one another.
Teacher Support	Extent to which teachers provide help when needed by students.
Involvement	Extent to which students have attentive interest, participate in discussions, perform additional work and enjoy the class.
Task Orientation	Extent to which students complete planned activities and stay on the subject matter.
Investigation	Extent to which students consider the skills and processes of inquiry.
Cooperation	Extent to which students cooperate on learning tasks.
Equity	Extent to which students are treated equally by the teacher.

Based on Fraser et al. (1996)

Chapter 2, Section 2.3.8 provides a comprehensive review of studies from many countries that attest to the validity and usefulness of the WIHIC. Previously the WIHIC has been used mainly with Western students, but a number of important studies carried out in non-Western countries have established its validity and replicated associations between student outcomes and classroom environment perceptions (Dorman, 2008). For example, the WIHIC has been cross-validated with samples of students from United Arab Emirates (Afari et al., 2013; MacLeod & Fraser, 2010), Korea (Kim et al., 2000), India (Koul & Fisher, 2005), Singapore (Chionh & Fraser, 2009; Lim & Fraser, in press), Australia and Taiwan (Aldridge & Fraser, 2000), Indonesia (Fraser et al., 2010) and the USA (Skordi & Fraser, in press; Taylor

& Fraser, 2013). I selected the WIHIC for my study because of the salience of its scales and its proven validity in many past studies.

3.4.2 Enjoyment of Science Lessons Scale

As discussed in Section 2.5.1, in addition to using the WIHIC to assess the learning environment, my study also included numerous scales to assess students' attitudes to science. The first of these attitude scales is the Enjoyment of Science Lessons scale from the Test of Science Related Attitudes (TOSRA, Fraser, 1978, 1981b). The TOSRA contains seven scales that assess different aspects of attitude to science, but it was only the Enjoyment scale that was considered of central importance to my study of science students in Afghanistan.

The modified version of the Enjoyment scale (also called Attitude to Subject) contains the 8 items listed in Appendix A. A typical item is "I enjoy lessons in this subject" and all items are responded to using the same five-point frequency scale as the WIHIC (i.e., Almost Never, Seldom, Sometimes, Often and Very Often).

One of the reasons for selecting a scale from TOSRA is that it has been cross-validated and found useful in dozens of studies around the world (see Section 2.5.1). These studies in science education include countries such as Korea (Fraser & Lee, 2015), Australia (Fraser & Fisher, 1982), Singapore (Wong & Fraser, 1996) and Indonesia (Fraser, Aldridge & Adolphe, 2010). Additionally, TOSRA has been cross-validated and used in non-science subjects such as geography (Walker, 2006), mathematics

(Ogbuehi & Fraser, 2007), Spanish (Adamski, Fraser & Peiro, 2013) and English (Liu & Fraser, 2013).

3.4.3 Students' Adaptive Learning Engagement in Science (SALES)

In addition to the Enjoyment scale from TOSRA, the SALES also was chosen for measuring attitudes in my study because of the salience of its scales for my research and its proven validity in past research (see Section 2.5.2). At the time when I commenced my study, the SALES was still under development and was made available to me in a preliminary form by its author (Velayutham, 2010, personal communication).

Table 3.3 lists the name of each of the five scales in the preliminary version of the SALES, together with a sample item for each scale. This table shows that, in my study, I used four of the scales in the SALES' preliminary version but decided to omit Self-Efficacy. Omitting one SALES scale reduced administration time and the interruption to school schedules and created space to include the Enjoyment of Science Lessons scale described in Section 3.4.2. Advice from science teachers in Afghanistan supported my choice to include Enjoyment and to exclude Self-Efficacy. Table 3.3 also indicates that the final published version of the SALES also was reduced to four scales by omitting the Performance Goal Orientation scale (Velayutham, 2012; Velayutham, Aldridge & Fraser, 2011).

The thorough initial development of the SALES followed three stages described by Velayutham et al. (2011, pp. 2166-2167) in the following way:

> *"Stage 1 involved identifying and defining salient student motivation and self-regulation scales and consisted of two steps. Firstly, an extensive review of theories and research related to student motivation and self-regulation was carried out. . . .The second step was to define concisely the scales identified in step one based on the analysis of literature.*
> *Stage 2 involved writing individual items within the scales. Firstly, items from previously validated questionnaires were examined and, if appropriate, adapted. Secondly, suitable items were written for each scale. Once the items for each scale had been adapted or written, ten experienced science teachers were asked to assess the comprehensibility, clarity and accuracy of items for each scale.*
> *Stage 3 commenced with a pilot study conducted with 52 students in two grade 8 science classes. Twelve students, six from each of these two classes, based on their willingness to participate, were selected for semi-structured interviews. . . . The main purpose of the interviews was to confirm whether students were responding to the items on the basis intended."*

The 8 items contained in each of the four SALES scales used in my study are provided in English in Appendix A and in Dari in Appendix B. The response alternatives involved a five-point Likert sale consisting of Strongly Disagree, Disagree, Not Sure, Agree and Strongly Agree (scored 1, 2, 3, 4 and 5).

The cross-validation of my translated version of the SALES is reported in the next chapter. Past research has supported the validity of the final version of the SALES with the following samples:

- 1360 grade 8–10 students in 78 classes in Australia (Velayutham, Aldridge & Fraser, 2011)
- 327 college students in the USA, the UAE and Turkey (Pasha-Zaidi et al., in press)
- 495 grade 6–8 students in 31 classes in the USA (Koren & Fraser, 2013)
- 431 middle-school science students in Australia (Rogers & Fraser, 2013).

Table 3.3 Scale Description and Sample Item for Each of Five Scales in Preliminary Version of SALES

Scale	Scale description	Sample item	Included in Velayutham's Preliminary Version	Included in My Study	Included in Velayutham et al. Final Version
Learning Goal Orientation	Degree to which the student perceives him/herself to be participating in the classroom for the purpose of learning, understanding and mastering concepts and improving skills.	It is important for me to learn the content that is taught.	✓	✓	✓
Performance Goal Orientation	Degree to which the student considers it important to demonstrate competence, especially to other people.	I want other students to think that I am clever.	✓	✓	X
Task Value	Degree to which the student perceives the science learning tasks in terms of interest, importance and utility.	What I learn can be used in my daily life.	✓	✓	✓
Self-Regulation	Degree to which the student controls and regulates his/her effort in learning tasks.	Even when tasks are uninteresting, I keep working.	✓	✓	✓
Self-Efficacy	Degree to which students are confident and believe in their own ability to perform learning tasks successfully.	Even if the work is hard, I can learn it.	✓	X	✓

Based partly on Velayutham (2012)

3.4.4 Modifying and Translating Scales for Use in Afghanistan

Scrutiny of questionnaire items suggested that most were suitable for use in my study with no or only minor changes to ensure relevance. Afghans speak in many different dialects, but the main languages of communication are Dari and Pashto. Therefore, my questionnaires (WIHIC, TOSRA and SALES) were translated into Dari, including a rigorous process of back translation (Bracken & Barona, 1991; Brislin, 1970, 1983; Warwick & Osherson, 1973).

The first step of the process involved an independent and qualified educator, who was fluent in both English and Dari, in translating the instruments into Dari. Each item was translated into Dari by a professional translator from Afghanistan to ensure that cultural, lexical and grammatical considerations were taken into account. The second step involved another independent translator, who had not seen the English version of the instruments, in back translating them into English. This back-translation was undertaken by an independent expert in both languages who was not familiar with the original English version of the questionnaires. This enabled a comparison of the two English versions to be made to ensure that they were semantically consistent in meaning.

The final version was pilot-tested with two classes in Afghanistan (an all-female class and an all-male class) to check the readability and comprehensibility of the items in the questionnaire.

3.5 DATA COLLECTION

In addition to check points and inspections along the way, there were other obstacles to the smooth collection of the quantitative data. These obstacles were related to school access, teacher co-operation, travel and difficulties involving airports and flights.

3.5.1 Access to Schools

When I approached several school principals, they advised me to seek formal approval through the Ministry of Education. But, when I contacted the Ministry to obtain approval to visit Government schools, my application was rejected. The rationale provided was that the Ministry thought it extremely undesirable for research information to leave Afghanistan or be used for a private research. I used contacts previously established to approach the Director of Education for Kabul; again my application was immediately rejected. Reasons provided included not wanting student time wasted, information possibly appearing in either the press or other media, or information leaving Afghanistan.

I explained to the Kabul Director of Education that all ethical and confidentiality aspects of the study had been approved by the Curtin University's Human Research Ethics Committee, and that additional information outlining the nature of participation and the purposes of the study also would be provided to all participants. Also the rights to voluntarily participation and to withdraw from the study at any time without prejudice would be made explicit, pseudonyms would be used throughout to avoid identification and protect confidentiality, and a coding system would be used. Despite

these assurances, the Kabul Director steadfastly refused to authorise the cooperation of school principals.

A quandary presented itself: the relevant authorities would not issue an authorisation and the principals would not allow me to collect data without authorisation. My only viable option was to use personal contacts, friends and relatives who knew the principals of the relevant schools in Kabul to influence them to cooperate with me. Although I considered abandoning Kabul and instead travelling to other provinces with their own Directors of Education, Kabul remained a critically important location to include in my research.

3.5.2 Travelling in Afghanistan

Travelling in and around Kabul in order to reach the schools was problematic. On each occasion, there were numerous check points that had to be crossed on the way to the destination. There were a few of us travelling in a van, two people helping with carrying the boxes of questionnaires and a driver and a photographer who was filming the distribution and administration of the questionnaires.

At each checkpoint, the van was searched and the questionnaires were checked. We were required to explain in detail the purpose of the questionnaires. In many cases, the inspectors, who were accustomed to bribery (as is the norm in most parts of Afghanistan), took the opportunity to extort money. This often involved a senior inspector re-checking the boxes, or referring us to their head office, which led to lengthy delays. As our return route was usually different from the route out to the

schools, we encountered different check points. For this to be successful, a senior inspector was required to re-check the boxes, leading to further delays. In addition to the check points, the journeys to schools were hampered by over-crowded streets. Kabul was originally designed for a population of 40,000 but currently it accommodates 5,000,000 inhabitants. Most streets are one-way, making our movement in Kabul very slow.

It was not uncommon for our entry into schools to take several hours. In all cases, a pass had to be formally issued by the principal. It was not possible to accomplish this prior to our arrival because identification had to be checked on arrival. Contact between the school gate and the principal was limited by lack of intercom systems and a limited mobile network. Therefore, in all cases, a person would be required to physically leave his/her post to look for the principal; sometimes he/she refused to do so. Thus, in most cases, we were forced to linger at the entrance waiting for the appearance of a teacher who would be willing to take a message to the principal. In some cases, the principal was not available and we were unable to gain entry.

3.5.3 Administration of Questionnaires

The process outlined below was the basis of questionnaire administration in each classroom that I visited:

- The principals, science teachers and the heads of departments were briefed by the researcher about the procedure for questionnaire administration before the distribution of the questionnaires to the students.

- I read the questions to the students in each class, ensuring that the items were fully understood by the students. In several classes, the teachers assisted me by elaborating on the questions to students.
- Once the questions were fully understood by all students, they were asked to proceed with answering them with honesty and sincerity. I emphasised that their anonymity was assured.
- The students were given three class periods, totaling 90 minutes in duration, to complete the WIHIC, Enjoyment and SALES scales.
- The administration of the questionnaires was undertaken by me personally in the presence of subject teachers.
- I personally collected the questionnaires at the conclusion of administration.

3.6 DATA ANALYSIS

3.6.1 Research Question 1

Given that the WIHIC and SALES were modified and translated into Dari, it was necessary to check that they were valid and reliable when used in Afghani high schools in my study. To examine whether the translated versions of these two questionnaires were valid and reliable, the data collected from 1619 students were used to examine the factorial validity and scale reliability.

The structure of the 56 items in the Dari version of the WIHIC's seven scales was checked using principal axis factor analysis with oblimin rotation and Kaiser normalisation for my sample of 1619 students. The criteria for the retention of any

item were that it must have a factor loading of at least 0.40 with its own scale and less than 0.40 with each of the other scales.

To check the structure of 32 items in the Dari version of SALES' four scales, a similar principal axis factor analysis was conducted for my sample of 1619 students. The same criteria (factor loading of 0.40) for item retention was adopted.

The internal consistency reliability of each WIHIC, Enjoyment and SALES scale was determined using Cronbach's (1951) alpha coefficient using the student as the unit of analysis with my sample of 1619 students. Reliability coefficients above the 0.60 are generally acceptable according to Nunnally (1978).

3.6.2 Research Question 2

To identify which aspects of the learning environment are associated with students' attitudes (Enjoyment and the four SALES scales of Learning Goal Orientation, Performance Goal Orientation, Task Value and Self-Regulation) in Afghanistan, simple correlation and multiple regression analyses were used. Simple correlation analysis provided information about the bivariate association between each student attitude outcome and each learning environment scale (Student Cohesiveness, Teacher Support, Involvement, Task Orientation, Investigation, Cooperation and Equity). For each outcome scale as the dependent variable, a multiple regression analysis was performed with the set of seven WIHIC scales as the independent variables and using the individual student as the unit of analysis. To identify which specific WIHIC scales

were still related to an attitudinal outcome when the other WIHIC scales were all simultaneously controlled, regression weights were examined.

3.6.3 Research Question 3

My third research question focused on two determinants of students' scores on the learning environment scales (WIHIC) and attitude scales (Enjoyment and SALES). The two determinants were student sex and school location (urban, rural).

For my sample of 1619 students, descriptive statistics (mean and standard deviation) were calculated separately for males and females for each learning environment and attitude scale. In order to check the statistical significance of sex differences in scale scores, MANOVA was conducted with the set of seven WIHIC scales, Enjoyment and the four SALES scales as dependent variables and with sex as the independent variable. If this multivariate test using Wilks' lambda criterion yields overall sex differences for the whole set of dependent variables, then the univariate ANOVA would be interpreted separately for each WIHIC, Enjoyment and SALES scale.

As well as investigating the statistical significance of sex differences, the effect size or magnitude of the sex difference was calculated for each scale. The between-sexes difference in the average item means on each scale was expressed as Cohen's (1988) *d* effect size (i.e. the number of standard deviations) as recommended by Thompson (2001). Cohen's *d* is calculated by dividing the difference between two means by the pooled standard deviation. Cohen (1988) provides some tentative guidelines for what might be considered 'small' and 'large' effect sizes.

Location (urban/rural) differences in learning environment and attitude scales were investigated using the same methods as those used for sex differences. First, for my sample of 1619 students, descriptive statistics (mean and standard deviation) were calculated separately for urban and rural students for each scale. Second, MANOVA was conducted with location as the independent variable and the set of 12 learning environment and attitude scales as the dependent variables. If the multivariate test using Wilks' lambda criterion yielded statistically significant differences between locations for the set of dependent variables as a whole, then the univariate ANOVA would be interpreted for each individual dependent variable. Third, Cohen's *d* effect size was calculated as a measure of the magnitude of location differences on each scale.

3.7 ETHICAL CONSIDERATIONS

For any research involving humans (as in my study), guiding ethical principles in dealing with participants are of great importance (Cohen, Manion & Morrison, 2000; NHMRC, 1999). Five important protocols identified by Howitt (2008) were observed in my study: *information* (my study's purposes were explained); *permission* (written permission was obtained from school personnel and parents); *privacy and confidentiality* (a written guarantee of confidentiality and anonymity was provided); *consideration* (minimal disruption to schools was ensured); and *acknowledgement* (the cooperation and contribution of participants were acknowledged anonymously).

Before collecting any data for my research, I applied for and received approval from Curtin University's Human Research Ethics Committee (HREC). This approval was granted on 7 May, 2010 with the approval number of SMEC-17-10 (see Appendix C).

Also prior to conducting my research, I applied for approval from the bureaucracy in the Department of Education in Kabul. First, I met the Education Director of Kabul, who suggested that I contact the Director of Education in Parwan province before collecting data from Kabul. Therefore, I traveled to the Department of Education in Parwan to obtain permission from the Director of Education to collect data from Parwan secondary schools. Permission was also granted from the capital Kabul and research was conducted in some secondary schools in Kabul.

In particular, all participants were informed by the researcher of their right to participate or not and to withdraw at any time without penalty. Participants' consent was obtained and their anonymity was ensured.

For the purpose of confidentiality, I assigned a number for each school. Each box had a corresponding number, and I closely supervised the transportation of the boxes. The confidentiality of the information collected was of great importance to all parties involved. As previously mentioned, there is a pervasive fear of authority at every level of society in Afghanistan. Therefore, students were fearful of their teachers' reactions, teachers were fearful of principals' reactions, and principals were fearful of the Department of Education's and Government's reactions to collecting information. Therefore, everyone's concerns had to be continually allayed.

The concepts of honour and humiliation permeate all relationships and activities in Afghanistan. For example, when I took the boxes of completed questionnaires straight to the car, in the interest of protecting confidentiality, I had to deal with principals feeling offended because I had not shown due respect to them by transporting the material through their office and allowing them to show everyone that they had consented to the material leaving the school. It was the a balancing act to keep all parties engaged and respected throughout the study.

3.8 SUMMARY OF CHAPTER

The purpose of Chapter 3 was to outline the research methods used in my study involving the assessment, effects and determinants of the learning environment of science classrooms in Afghanistan. After restating my three research aims in Section 3.2, next I established in Section 3.3 that my sample comprised 1619 grades 10–12 science students from 23 government and private schools in two provinces of Afghanistan (namely, the capital of Kabul and Parwan). The number of male and female students was roughly the same (with a somewhat larger number of females).

Next, in Section 3.4, I described the questionnaires that I selected and translated into the Dari language to measure classroom learning environment and student attitudes. To assess students' perceptions of the learning environment, I selected all of the seven eight-item scales contained in the What Is Happening In this Class? (WIHIC): Student Cohesiveness, Teacher Support, Involvement, Task Orientation, Investigation, Cooperation and Equity (Aldridge et al., 1999). One of the scales that I used to assess student attitudes was the Enjoyment of Science Lessons Scale from the Test of Science

Related Attitudes (TOSRA, Fraser, 1981b). Both the WIHIC and Enjoyment scales employed a five-point frequency response scale of Almost Never, Seldom, Sometimes, Often and Very Often. Also to assess attitudes, I used four eight-item scales from the Student Adaptive Learning Engagement in Science questionnaire (SALES, Velayutham, 2010, private communication; Velayuthan et al., 2011): Learning Goal Orientation, Performance Goal Orientation, Task Value and Self-Regulation. The SALES used a five-point Likert response scale (Strongly Disagree, Disagree, Not Sure, Agree and Strongly Agree).

In Section 3.5, I identified some of the extremely difficult circumstances associated with gaining access to and cooperation from school and with travel in Afghanistan (Section 3.5.1 and 3.5.2), as well as procedures for questionnaire administration (Section 3.5.3).

Section 3.6 was devoted to the methods of data analysis used to answer my three research questions. Given that the learning environment scales (WIHIC) and attitude scales (Enjoyment and SALES) were modified and translated into Dari, it was necessary to ensure that they were valid and reliable when used in Afghani high schools (my first research question). To examine whether the translated versions of the WIHIC and SALES were valid and reliable, the data collected from 1619 students were used to examine the factorial validity (principal axis factoring with oblimin rotation and Kaiser normalisation) and scale reliability (Cronbach's alpha reliability coefficient). Also the reliability of TOSRA's Enjoyment scale was checked.

To answer my second research question concerning the effects of classroom environment, I investigated associations between the seven WIHIC scales and five student attitude scales. Simple correlation and multiple regression analyses were conducted. Simple correlation analysis provided information about the bivariate association between each of environment factor and each student attitude (i.e. Enjoyment of Science Lessons and the four SALES scales of Learning Goal Orientation, Performance Orientation, Task Value and Self-Regulation). Multiple regression analysis provided multivariate information about the joint and unique contributions of the environment scales to each attitude scale (enjoyment and the four SALES scales). The standardised regression coefficient indicated the unique contribution of each WIHIC scale to a student attitude scale when all of the other WIHIC scales were mutually controlled.

My third research question involved two determinants of classroom learning environment, namely, student sex and school location (urban/rural). To examine sex differences in both learning environment perceptions and student attitudes, MANOVA was conducted with the seven WIHIC scales and five attitude scales (namely, enjoyment and the four SALES scales) and the dependent variables and with sex as the independent variable. Initially conducting MANOVA reduced the Type 1 error rate that would be associated with conducting a separate ANOVA for each dependent variable. If the multivariate test using Wilks' lambda criterion revealed statistically significant sex differences for the whole set of WIHIC and attitude scales, only then would the univariate ANOVA for each individual dependent variable be considered. In addition to investigating the statistical significance of sex differences, their magnitude (or educational importance) was investigated using Cohen *d* statistic in

order to express a sex difference in standard deviation units. To investigate school location (urban/rural) differences in learning environment and student attitudes, similar MANOVA and effect size analyses were conducted.

Finally, ethical issues associated with my research involving humans were discussed in Section 3.7. In particular, approval from Curtin University's Human Research Ethics Committee was confirmed. In the next chapter, my results are reported and my three research questions are answered.

Chapter 4

ANALYSES AND RESULTS

4.1 INTRODUCTION

The main purpose of this chapter is to report analyses and results for my study's three overarching aims involving the (1) assessment, (2) effects and (3) determinants of classroom learning environments in Afghanistan. My sample consisted of 1619 grade 10 and 12 students, with 649 males and 970 females and with 718 urban students and 901 rural students, from the capital Kabul and the province of Parwan.

In Afghanistan, there are virtually no co-educational schools. Therefore, my sample involved science classes (biology, chemistry and physics) from 7 government and 16 private single-sex schools (both all-male and all-female schools; see Table 3.1). The selection of schools was limited because of the high level of security in Kabul and Parwan (the nearest province to Kabul) as discussed in Chapter 3 (Sections 3.5.1 and 3.5.2).

The results of the present study are reported in this chapter, using the following headings:

- Assessment: Validity and Reliability of Instruments (Section 4.2);
- Effects: Associations Between Learning Environment and Attitude Scales (Section 4.3);
- Determinants: Sex and Location as Determinants of Learning Environment and Attitudes (Section 4.4).

As noted in Chapter 3, my study involved the administration of Dari-language versions of numerous questionnaire scales. First, to measure students' perceptions of their classroom learning environment, I used the following seven scales from the What Is Happening In this Class? (WIHIC, Aldridge, Fraser & Huang, 1999):

- Student Cohesiveness
- Teacher Support
- Involvement
- Task Orientation
- Investigation
- Cooperation
- Equity.

The WIHIC was described in detail in Chapter 2 (Section 2.3.8) and Chapter 3 (Section 3.4.1). Second, to assess students' enjoyment of their science classes, I chose the Enjoyment of Science Lessons scale from the Test of Science Related Attitudes (TOSRA, Fraser, 1981b). Third, to assess other student attitudes, I made use of all four scales selected from a preliminary version of the Students' Adaptive Learning Engagement in Science instrument (SALES, Velayutham, Aldridge & Fraser, 2011):

- Learning Goal Orientation
- Performance Goal Orientation
- Task Value
- Self-Regulation.

These attitude scales were described in detail in Chapter 2 (Section 2.5) and Chapter 3 (Sections 3.4.2 and 3.4.3).

4.2 ASSESSMENT: VALIDITY AND RELIABILITY OF INSTRUMENTS

Because the questionnaires used in my study were originally developed and validated in English Western settings, it was important to ensure that the Dari version of each instrument was valid and reliable when used with high-school students in Afghanistan. Therefore, this section is devoted to addressing the first research objective of the study concerning the validity of WIHIC (What Is Happening In this Class?) and SALES (Students' Adaptive Learning Engagement in Science) instruments.

As described in Section 3.3 of Chapter 3, data were collected from 1,619 students in 23 schools. The sample involved 28 all-female classes from 8 private all-female schools and 6 all-female classes from 3 all-female government schools, amounting to a total of 970 females. Data were also collected from males in 10 classes from 4 all-male government schools and 30 classes from 8 all-male private schools, making a total of 649 males. Data were collected from both the capital, Kabul, and the Parwan province. These data were analysed in various ways to examine the validity and reliability of the WIHIC (described in Section 4.2.2.1) and SALES (described in Section 4.2.2.2).

4.2.1 Modification, Translation and Pilot-testing of Questionnaires

As discussed in Chapter 3 (Section 3.4.4), the WIHIC, Enjoyment and SALES scales were translated into Dari by the former acting Minister for Tertiary and Higher Education of Afghanistan, who holds a Master degree from Oxford University in London. Although Afghans speak in many different dialects, the main languages of communication are Dari and Pashto. My Dari version was back translated into English, as recommended by Brislin (1983) and Bracken and Barona (1991), by a prominent educator of the Ministry of Education in Afghanistan, who is an independent American-educated expert in both languages and who was not familiar with the original English version of the questionnaires. This enabled comparison of the Dari and English versions and ensured that they were consistent in meaning, as well as identifying any minor changes needed to better align the English and Dari versions.

The final versions of the instruments were pilot tested in two classes in Afghanistan (an all-female class and an all-male class) by administering them to 10 students to ensure readability and comprehensibility. The original wording of the items was not changed, but items were explained to students for ease of understanding of the original wording and to remove any complexity from students' minds. The researcher read the questionnaires aloud to students with low literacy levels. Finally, three students from each class (selected to provide a range of academic and literacy abilities) were interviewed to ensure that the items were interpreted in ways intended by the researcher. Because students interpreted items in ways consistent with the researcher's

intention, the instruments were considered suitable without the need to make only quite minor modifications.

Interviews suggested that some students were reluctant to respond with either highly-negative or highly-positive opinions about their teachers or peers. This is consistent with the school culture throughout Afghanistan in that, because of a high level of respect or fear, students are concerned about creating adverse relationships with teachers and peers. Therefore assurance of anonymity was given during questionnaire administration in the main study.

4.2.2 Validity and Reliability of Questionnaire Scales

The data collected from my samples of 1619 students in 23 schools described in Chapter 3 were analysed to examine the validity and reliability of the WIHIC. Below are reported the factor structure for the WIHIC (Section 4.2.2.1), the factor structure for the SALES (Section 4.2.2.2) and the internal consistency reliability of all WIHIC, Enjoyment and SALES scales (Section 4.2.2.3).

4.2.2.1 Factor Analysis for WIHIC

Factor analysis is a statistical technique for reducing data in order to identify a small number of underlying factors/variables to explain most of the variance in a larger number of variables (Kim & Mueller, 1978). Using the data obtained from 1,619 students, factor analysis was conducted in order to identify any items that needed to be removed in order to improve the factorial validity of the WIHIC.

Principal axis factor analysis with oblimin rotation and Kaiser normalisation was used to examine the factor structure of the 56 items in the Dari version of the WIHIC's 7 scales. The criteria for the retention of any item were that it must have a factor loading of at least 0.40 on its own scale and less than 0.40 on all other scales. The results, reported in Table 4.1, show that 46 of the 56 WIHIC items satisfied both of these criteria and, therefore, were retained.

It can be seen in Table 4.1 that the following 10 items were removed to improve the WIHIC's factor structure: Items 1, 2, and 7 from Student Cohesiveness; Item 16 from Teacher Support; Item 17 from Task Orientation; Items 33, 34, 35 and 40 from Investigation; and Item 43 from Cooperation.

The bottom of Table 4.1 also reports the percentage of variance accounted for by different scales and the eigenvalue for each scale. The percentage of variance accounted for by the different WIHIC scales ranged from 2.92% to 23.16%, with the total being 47.68%. Table 4.1 shows that the eigenvalues for different scales ranged from 1.34 to 10.65. It is noteworthy that the eigenvalues for all factors/scales are above 1, which is the minimum value for factors to be meaningful (Kaiser, 1974).

Table 4.1 Factor Analysis Results for the Dari Version of the WIHIC

Item No.	Factor Loading						
	Student Cohesiveness	Teacher Support	Involvement	Task Orientation	Investigation	Cooperation	Equity
3	0.58						
4	0.67						
5	0.56						
6	0.53						
8	0.50						
9		0.55					
10		0.69					
11		0.57					
12		0.46					
13		0.49					
14		0.64					
15		0.59					
17			0.62				
18			0.64				
19			0.50				
20			0.67				
21			0.45				
22			0.70				
23			0.60				
24			0.56				
25				0.54			
26				0.49			
28				0.72			
29				0.55			
30				0.74			
31				0.64			
32				0.55			
36					0.58		
37					0.58		
38					0.46		
39					0.48		
41						0.53	
42						0.59	
44						0.47	
45						0.64	
46						0.63	
47						0.56	
48						0.42	
49							0.67
50							0.75
51							0.73
52							0.71
53							0.76
54							0.76
55							0.70
56							0.74
% variance	3.38	3.15	23.16	4.86	2.92	3.87	6.35
Eigenvalues	1.56	1.45	10.65	2.34	1.34	1.78	2.92

Principal axis analysis with oblimin rotation and Kaiser normalisation
Factor loading smaller than 0.40 have been omitted.
N=1,619 students from 23 schools
Total proportion of variance = 47.68%

4.2.2.2 Factor Analysis for SALES

Using SALES data obtained from 1,619 students, factor analysis also was conducted to identify SALES items whose removal would improve the factorial validity of these attitude scales. Principal component analysis with oblimin rotation and Kaiser normalisation was conducted for the 32 SALES items in 4 scales. The criteria for the retention of any item were that it must have a factor loading of at least 0.40 on its own scale and less than 0.40 on the other scales. The results reported in Table 4.2 show that all the 16 SALES items met both criteria and therefore were retained.

Table 4.2 also reports the percentage of variance accounted for and the eigenvalue for each scale. The percentage of variance accounted for by the four SALES scales ranged from 4.65% to 41.68%, with the total being 63.94%. Also the bottom of Table 4.2 shows that the eigenvalues for the four scales ranged from 1.49 to 13.34 and therefore satisfied the minimum cut-off criterion of 1.0 for factors to be meaningful (Kaiser, 1974).

Table 4.2 Factor Analysis Results for Dari Version of the SALES

Item	Factor Loadings			
	Learning Goal Orientation	Performance Goal Orientation	Task Value	Self-Regulation
LGO 65	0.86			
LGO 66	0.90			
LGO 67	0.90			
LGO 68	0.89			
LGO 69	0.91			
LGO 70	0.92			
LGO 71	0.88			
LGO 72	0.71			
PGO 73		0.79		
PGO 74		0.69		
PGO 75		0.88		
PGO 76		0.67		
PGO 77		0.77		
PGO 78		0.86		
PGO 79		0.81		
PGO 80		0.72		
TV 81			0.42	
TV 82			0.57	
TV 83			0.57	
TV 84			0.58	
TV 85			0.60	
TV 86			0.53	
TV 87			0.48	
TV 88			0.42	
SR 89				0.65
SR 90				0.45
SR 91				0.73
SR 92				0.80
SR 93				0.83
SR 94				0.83
SR 95				0.77
SR 96				0.74
% variance	10.94	41.68	4.65	6.68
Eigenvalues	3.50	13.34	1.49	2.14

Principal axis analysis with oblimin rotation and Kaiser normalisation
Factor loadings smaller than 0.40 have been omitted.
N = 1619 students from 23 schools
Total proportion of variance = 63.94%

4.2.2.3 Internal Consistency Reliability of WIHIC, Enjoyment and SALES Scales

Internal consistency is a method of estimating the reliability of a scale based on a single administration. It provides an indication of whether items in the same scale are measuring a common construct. In the current study, the internal consistency reliability was calculated using Cronbach's (1951) alpha coefficient for each scale, namely, the seven WIHIC scales, the Enjoyment scale and the four SALES scales. Table 4.3 shows that the alpha coefficient for different WIHIC scales ranged from

0.65 to 0.90, for the Enjoyment scale was 0.62, and for the four SALES scales ranged from 0.82 to 0.95.

Table 4.3 Internal Consistency Reliability (Cronbach Alpha Coefficient) for WIHIC, Enjoyment Scale and SALES

Scale	No. of Items	Mean	SD	Alpha Reliability
Learning Environment (WIHIC)				
Student Cohesiveness	5	4.18	0.74	0.65
Teacher Support	7	3.25	0.88	0.75
Involvement	8	3.55	0.77	0.81
Task Orientation	7	4.32	0.69	0.79
Investigation	4	3.69	0.83	0.77
Cooperation	7	3.58	0.79	0.74
Equity	8	4.03	0.95	0.90
Enjoyment	8	3.13	0.66	0.62
Attitudes (SALES)	8			
Learning Goal Orientation	8	3.71	1.28	0.95
Performance Goal Orientation	8	3.77	1.06	0.92
Task Value	8	3.65	0.86	0.82
Self-Regulation	8	3.88	0.91	0.88

N=1,619 students from 23 schools.

Given that all scales were originally developed in English for use in Australia, it is noteworthy that the reliability of the Dari version of every scale exceeded the minimum satisfactory value of 0.60 recommended by Nunnally (1978).

4.3 EFFECTS: ASSOCIATIONS BETWEEN LEARNING ENVIRONMENT AND ATTITUDE SCALES

To answer my second research question, associations between attitude and learning environment scales were investigated using simple correlation and multiple regressions analyses as reported in Table 4.4. The five attitude scales involved were Enjoyment of Lessons and the four SALES scales of Learning Goal Orientation, Performance Goal Orientation, Task Value and Self-Regulation.

The simple correlation analysis provides information about the bivariate relationship between each attitude scale and each learning environment scale. The multiple regression analysis provides a test of the combined influence of all of the seven learning environment scales on each attitude scale. In order to determine which specific learning environment scales accounted for most of the variance in an attitude scale, standardised regression weights were examined. The regression coefficient (β) indicates the strength of the association between each learning environment scale and an attitude scale when the other six learning environment scales are mutually controlled.

Table 4.4 report results for the simple correlation analysis and the multiple regression analysis (multiple correlations and standardised regression weights). This table reveals that the multiple correlation was statistically significant (p<0.01) for each of the five attitude scales. Also, the association between an attitude scale and a learning environment scale was significant in 28/35 cases for the simple correlations and in 13/35 cases for the regression weights (Table 4.4).

The statistically-significant bivariate associations (simple correlations) and multivariate associations (regression weights) between attitude and learning environment scales in Table 4.4 are summarised below:

- For Enjoyment, the simple correlation was significant for all WIHIC scales except Equity and three WIHIC scales (Investigation, Task Orientation and Cooperation) were significant independent predictors.
- For Learning Goal Orientation, the simple correlation was significant for three

WIHIC scales (Student Cohesiveness, Task Orientation and Equity) and two of these WIHIC scales (Task Orientation and Equity) were significant independent predictors.

- For Performance Goal Orientation, the simple correlation was significant for five WIHIC scales (Student Cohesiveness, Involvement, Investigation, Task Orientation and Equity) and two of these WIHIC scales (Task Orientation and Equity) were significant independent predictors.
- For Task Value, the simple correlation was significant for every WIHIC scale and two WIHIC scales (Task Orientation and Equity) were significant independent predictors.
- For Self-Regulation, the simple correlation was significant for all WIHIC scales except Cooperation and three WIHIC scales (Student Cohesiveness, Task Orientation and Equity) were significant independent predictors).

The fact that every statistically-significant bivariate and multivariate association between a learning environment scale and an attitude scale in Table 4.4 was positive replicates for Afghanistan considerable prior research in other countries (Fraser, 2012, 2014). Nevertheless, it is noteworthy that the magnitude of environment-attitude associations in Table 4.4 in Afghanistan are somewhat smaller than those reported in numerous other countries (see review in Section 2.4.1).

Table 4.4 Simple Correlation and Multiple Regression Analyses for Associations of Learning Environment Scales with Enjoyment and SALES Scales

Scale	Attitude–Environment Associations									
	Enjoyment		Learning Goal Orientation		Performance Orientation		Task Value		Self-Regulation	
	r	*β*	*r*	*β*	*r*	*β*	*r*	*β*	*r*	*β*
Student Cohesiveness	0.16**	0.03	0.07**	0.05	0.10**	0.05	0.11**	0.05	0.15**	0.07*
Teacher Support	0.15**	0.05	0.03	0.00	0.05	-0.01	0.07**	0.00	0.05*	-0.04
Involvement	0.18**	-0.00	0.05	0.01	0.07**	-0.03	0.12**	0.06	0.14**	0.06
Task Orientation	0.23**	0.13**	0.11**	0.12**	0.18**	0.16**	0.15**	0.11**	0.23**	0.20**
Investigation	0.25**	0.15**	-0.02	-0.07	0.06*	-0.04	0.06*	-0.05	0.10**	-0.03
Cooperation	0.25**	0.16**	-0.03	-0.07	0.04	-0.07	0.06*	-0.05	0.04	-0.06
Equity	0.05*	-0.06**	0.16**	0.18**	0.16**	0.13**	0.13**	0.08**	0.17**	0.10**
Multiple Correlation (R)	*0.33***		*0.23***		*0.22***		*0.18***		*0.27***	

**$p<0.01$ *$p<0.05$
N=1619 students in 18 schools

4.4 DETERMINANTS: SEX AND LOCATION AS DETERMINANTS OF LEARNING ENVIRONMENT AND ATTITUDES

My third research question focused on two determinants of students' scores on the learning environment scales (WIHIC) and attitude scales (Enjoyment and SALES). The two determinants were student sex and school location (urban, rural). Sex differences are reported in Section 4.4.1, whereas school-location differences are reported Section 4.4.2.

4.4.1 Sex Differences in WIHIC and Attitude Scales

For my sample of 1619 students, descriptive statistics (mean and standard deviation) were calculated separately for males and females for each learning environment and attitude scale. These descriptive statistics, which are reported in Table 4.5, indicate that the average item mean for every learning environment and attitude scale was lower for females.

Table 4.5 Average Item Mean, Average Item Standard Deviation and Sex Difference (Effect Size and MANOVA Results) for WIHIC, Enjoyment and SALES Scales

Scale	Average Item Mean		Average Item Standard Deviation		Sex Difference	
	Male	Female	Male	Female	Effect Size (*d*)	*F*
Learning Environment (WIHIC)						
Student Cohesiveness	4.27	4.18	0.65	0.72	0.13	6.55**
Teacher Support	3.38	3.22	0.89	0.86	0.18	11.74**
Involvement	3.70	3.52	0.72	0.75	0.24	19.71**
Task Orientation	4.48	4.32	0.50	0.65	0.28	27.54**
Investigation	3.78	3.72	0.74	0.82	0.08	2.46
Cooperation	3.72	3.52	0.72	0.80	0.26	23.31**
Equity	4.14	4.04	0.94	0.91	0.11	3.65
Enjoyment	3.20	3.15	0.67	0.64	0.08	2.10
Attitudes (SALES)						
Learning Goal Orientation	3.86	3.62	1.24	1.31	0.19	12.47**
Performance Goal Orientation	3.95	3.70	0.93	1.11	0.24	20.71**
Task Value	3.82	3.55	0.78	0.89	0.32	33.32**
Self-Regulation	4.05	3.83	0.78	0.95	0.25	20.57**

** $p<0.01$

N=649 male students and 970 female students

Cohen's *d* effect size is the difference between means divided by the pool standard deviation.

In order to ascertain the statistical significance of sex differences in scale scores, MANOVA was conducted with the set of seven WIHIC scales, Enjoyment and the four SALES scales as dependent variables. Because this multivariate test using Wilks' lambda criterion yielded overall sex differences for the whole set of dependent variables ($p<0.01$), the univariate ANOVA was interpreted separately for each WIHIC, Enjoyment and SALES scale as shown in Table 4.5

The last column of Table 4.5 reports the statistical significance of differences between male and female groups. This table shows that sex differences were statistically significant ($p<0.01$) for the learning environment scales of Student Cohesiveness, Teacher Support, Involvement, Task Orientation and Cooperation and for all four SALES scales Learning Goal Orientation, Self-Efficacy, Task Value and Self-Regulation. (Sex differences were not statistically significant for Investigation, Equity and Enjoyment.)

As well as investigating the statistical significance of sex differences, I also explored the effect size or magnitude of the sex difference for each scale. In the second-last column of Table 4.5, the between-group difference in the average item means on each scale is expressed as Cohen's *d* effect size (i.e. the number of standard deviations) as recommended by Thompson (1998). Cohen's (1988) *d* is calculated by dividing the difference between two means by the pooled standard deviation. Table 4.5 shows that the effect size for sex differences in learning environments scales ranged from 0.08 standard deviations for Investigation to 0.28 standard deviations for Task Orientation. For Enjoyment, the effect size for sex differences was 0.08 standard deviations. For SALES scales, the magnitude of sex differences ranged from 0.19 standard deviations

for Learning Goal Orientation to 0.32 standard deviations for Task Value. According to Cohen (1988), these effect sizes suggest that sex differences were relatively small for the majority of scales.

It is noteworthy that, even if effect sizes for sex differences in Table 4.5 tend to be relatively small, the direction of the sex differences is the same for all 12 learning environment and attitude scales. Afghani male students reported more positive learning environment perceptions and attitudes to science in every case. This finding is different from the pattern reported in several studies in western countries in which females reported more positive learning environment perceptions (see studies reviewed in Section 2.4.2).

4.4.2 Differences Between Urban and Rural Students for WIHIC and Attitude Scales

Location (urban/rural) differences in learning environment and attitude scales were investigated using the same methods as those used for sex differences. First, for my sample of 1619 students, descriptive statistics (mean and standard deviation) were calculated separately for urban and rural students for each scale as shown in Table 4.6. This table shows that, for every learning environment and attitude scale, scores were higher for urban students than for rural students.

Second, MANOVA was conducted with location as the independent variable and the set of 12 learning environment and attitude scales as the dependent variables. Because the multivariate test using Wilks' lambda criterion yielded statistically significant (p<0.01) differences between locations for the set of dependent variables as a whole, the univariate ANOVA was interpreted for each individual dependent

variable as shown in Table 4.6. This table shows that location differences were statistically significant for every learning environment and attitude scale except Enjoyment.

Third, Cohen's *d* effect size was calculated as a measure of the magnitude of location differences on each scale. Table 4.6 shows that effect sizes ranged from 0.10 standard deviations (Teacher Support) to 0.34 standard deviations (Task Orientation) for learning environment scales, was 0.06 standard deviations for Enjoyment, and ranged from 0.22 standard deviations (Performance Goal Orientation) to 0.28 standard deviations (Task Value and Self-Regulation) for SALES scales. As was the case for sex differences reported in Section 4.4.1, the magnitudes of location differences in Table 4.6 are relatively small for most scales (Cohen, 1988).

Table 4.6 Average Item Mean, Average Item Standard Deviation and Differences Between Urban and Rural Schools (Effect Size and MANOVA Results) for WIHIC, Enjoyment and SALES Scales

Scale	Average Item Mean		Average Item Standard Deviation		Location Difference	
	Urban	Rural	Urban	Rural	Effect Size *(d)*	*F*
Learning Environment (WIHIC)						
Student Cohesiveness	4.24	4.10	0.67	0.80	0.19	14.64**
Teacher Support	3.29	3.20	0.89	0.86	0.10	4.15*
Involvement	3.65	3.44	0.76	0.78	0.27	28.90**
Task Orientation	4.42	4.19	0.60	0.76	0.34	47.99**
Investigation	3.75	3.60	0.78	0.88	0.18	13.31**
Cooperation	3.68	3.46	0.76	0.80	0.28	31.37**
Equity	4.13	3.91	0.91	0.97	0.23	23.14**
Enjoyment	3.15	3.11	0.65	0.68	0.06	1.19
Attitudes (SALES)						
Learning Goal Orientation	3.87	3.53	1.22	1.31	0.27	29.76**
Performance Goal Orientation	3.88	3.65	0.97	1.13	0.22	19.52**
Task Value	3.76	3.52	0.79	0.91	0.28	29.03**
Self-Regulation	4.00	3.75	0.80	1.00	0.28	31.14**

*$p<0.05$ ** $p<0.01$
N=718 urban students and 901 rural students
Cohen's *d* effect size is the difference between means divided by the pool standard deviation.

Although school location differences in Table 4.6 were not large (ranging from 0.06 to 0.34 standard deviations), these differences still were statistically significant for all scales except Enjoyment and also they were in the same direction for all scales. For every learning environment and attitude scale, urban students perceived more- positive classroom environments and reported more-positive attitudes for science. This trend is consistent with known differences in school facilities and teachers' qualifications between urban and rural schools in Afghanistan, as well as with the very limited amount of prior learning environment research on urban-rural differences (e.g. Randhawa & Michayluk, 1975).

4.5 CHAPTER SUMMARY

This chapter reported the results obtained when 1619 Afghani students' responses to seven learning environment (WIHIC) scales and five attitude scales (Enjoyment and SALES) were analysed in order to answer my three research questions concerning the assessment, effects and determinants of science classroom learning environments.

After the removal of 10 items, factor analysis supported a satisfactory structure for 46 WIHIC items in their original seven scales, which together accounted for 47.68% of the variance. For the SALES, factor analysis supported a satisfactory structure for all of the original 32 items in their original four scales, which together accounted for 63.94% of the variance. All learning environment attitude scales exhibited satisfactory reliability, with alpha coefficients ranging from 0.62 to 0.95 for different scales.

When simple correlation and multiple regression analyses were employed to investigate my second research question about associations between the seven learning environment scales and five attitude scales, the simple correlation was statistically significant in 28/35 cases and the regression coefficient was significant in 13/35 cases. In particular, Investigation, Task Orientation and Cooperation were significant independent predictors of Enjoyment; Task Orientation and Equity were significant independent predictors of Learning Goal Orientation, Performance Goal Orientation and Task Value; and Student Cohesiveness, Task Orientation and Equity were significant independent predictors of Self-Regulation.

To answer my third research question about student sex and school location (urban/rural) as determinants of classroom environment and student attitudes, I used MANOVA and effect sizes (Cohen's *d*). Sex differences in learning environment perceptions and attitudes were relatively small (0.08 to 0.32 standard deviations), but were statistically significant for 9 of the 12 scales and in the same direction for every scale (with males reporting more-positive scores). Location differences in learning environment perceptions and attitudes also were relatively small (0.06 to 0.34 standard deviations), but were significant for 11/12 scales and in the same direction for every scale (with more positive environments in urban schools).

Chapter 5

SUMMARY, DISCUSSION AND CONCLUSION

5.1 CHAPTER INTRODUCTION

This final chapter draws to a conclusion my thesis devoted to a study in Afghanistan involving the assessment, effects and determinants of science classroom learning environments. A summary of all previous chapters is provided in Section 5.2, especially a summary of key findings (Section 5.2.2). This chapter also discusses my study's significance (Section 5.3) and limitations (Section 5.4), and this leads naturally to the identification of suggestions for future learning environment research in Afghanistan (Section 5.5).

5.2 SUMMARY OF PREVIOUS CHAPTERS

5.2.1 Summary of Chapters 1–3

Chapter 1 introduced the thesis involving the assessment, effects and determinants of science classroom learning environments in Afghanistan, noting that this was the first learning environment study at any educational level in any subject area in Afghanistan. By way of background, Chapter 1 provided a rationale for the study, as well as some information about Afghanistan's educational system and cultural context. A brief introduction was provided to the field of learning environments, in which my study was located. My study's aims were stated and its significance identified.

Chapter 2 reviewed literature relevant to my study, beginning with some historical perspectives on the field of learning environments in Section 2.2. It was noted that work specifically in education drew inspiration from earlier work in business settings by Lewin and Murray and that, specifically in education, the foundations of learning environments research were laid in the USA by Walberg and Moos.

Numerous economical, extensively-validated and extensively-used questionnaires have been prominent in learning environments research. Therefore, Section 2.3 was devoted to reviewing eight instruments: the Classroom Environment Scale (CES), Learning Environment Inventory (LEI), Individualised Classroom Environment Questionnaire (ICEQ), My Class Inventory (MCI), Questionnaire on Teacher Interaction (QTI), Constructivist Learning Environment Survey (CLES) and Science Laboratory Environment Survey (SLEI).

Section 2.4 was devoted to reviewing past research involving learning environment questionnaires, including the effects of learning environment (i.e. associations between classroom environment and student outcomes) and some determinants of classroom environment (e.g. student sex and school location as in my research). However, the most popular application of learning environment dimensions as dependent variables in prior research has been in the evaluation of educational programs or innovations. The other applications of learning environment questionnaires reviewed were teacher-researcher attempts to improve classroom environments (Section 2.4.3) and cross-national studies (Section 2.4.4).

Because my study also involved students' attitudes to science, Section 2.5 reviewed ways of assessing attitudes, especially the widely-used Test of Science Related Attitudes because one of its seven scales (Enjoyment) was used in my research. As well, literature related to the Students' Adaptive Learning Engagement in Science (SALES) questionnaire was reviewed because four of its scales (Learning Goal Orientation, Performance Goal Orientation Task Value and Self-Regulation) also were translated and used in my study.

Chapter 3 outlined the research methods used in my study, starting in Section 3.3 with a description of my sample comprised of 1619 grades 10–12 science students from 23 government and private schools in two provinces of Afghanistan (namely, the capital of Kabul and Parwan). This was followed in Section 3.4 by a description of the questionnaires that I selected and translated into the Dari language to measure classroom learning environment and student attitudes.

To assess the learning environment, I selected all of the seven scales in the What Is Happening In this Class? (WIHIC): Student Cohesiveness, Teacher Support, Involvement, Task Orientation, Investigation, Cooperation and Equity. One of the scales used to assess student attitudes was the Enjoyment of Science Lessons Scale from the Test of Science Related Attitudes (TOSRA). Also, I used four scales from the SALES: Learning Goal Orientation, Performance Goal Orientation, Task Value and Self-Regulation). Data collection and associated challenges with access to schools were considered in Section 3.5.

Section 3.6 was devoted to the methods of data analysis. To examine whether the translated version of the two questionnaires were valid and reliable, the data collected from 1619 students were used to examine the factorial validity (principal axis factoring with oblimin rotation and Kaiser normalisation) and scale reliability (Cronbach's alpha coefficient). To answer my second research question concerning the effects of classroom environment, I investigated associations between the seven WIHIC scales and five student attitude scales using simple correlation (bivariate) and multiple regression analyses (multivariate). For my third research question involving two determinants of classroom learning environment (student sex and school location), MANOVA was conducted with the seven WIHIC scales and five attitude scales as the dependent variables and with sex or school location as the independent variable. As well, the magnitudes of differences were estimated in standard deviation units using Cohen's *d* statistic.

5.2.2 Summary of Chapter 4 (Results)

Chapter 4 reported analyses and results for my sample of 1619 students in order to answer my three questions concerning the assessment, effects and determinants of science classroom learning environments in Afghanistan. To answer my first research question about the validity and reliability of Dari-language questionnaire scales, I conducted a principal axis factor analysis with oblimin rotation and Kaiser normalisation separately for the seven learning environment scales (WIHIC) and the five attitude scales (Enjoyment and SALES). The criteria for item retention were that any item must have a factor loading of at least 0.40 on its own scale and less than 0.40

on all other scales. Additionally, the internal consistency reliability was estimated for each scale using Cronbach's alpha coefficient. The main results were:

- For the WIHIC, 46 of the original 56 items satisfied the criteria for retention and were retained in their original seven scales, which together accounted for 47.68% of the variance.
- For the attitude scales (Enjoyment and SALES), all 32 items met the criteria for retention in the original five scales, which together accounted for 63.94% of the variance.
- All 12 learning environment scales (WIHIC) and attitude scales (Enjoyment and SALES) had satisfactory reliability, with alpha coefficient ranging from 0.62 to 0.95 for different scales.

To answer my second research question about the effects of classroom environment, I explored associations between each of the five student attitude scales and each of the seven learning environment scales using simple correlations (bivariate relationships) and multiple regression analysis (multivariate relationships) between an attitude scale and a learning environment scale when the other learning environment scales were all mutually controlled. The main findings were:

- The simple correlation between a learning environment scale and an attitude scale was statistically significant in 28/35 cases (all WIHIC scales for Enjoyment, 3 WIHIC scales for Learning Goal Orientation, 5 WIHIC scales for Performance Goal Orientation, all 7 WIHIC scales for Task Value and 6 WIHIC scales for Self-Regulation).

- The multiple correlation for the whole set of seven WIHIC scales was statistically significant for each of the five attitude scales.
- Investigation, Task Orientation and Cooperation were significant independent predictors of Enjoyment.
- Task Orientation and Equity were significant independent predictors of Learning Goal Orientation, Performance Goal Orientation and Task Value.
- Student Cohesiveness, Task Orientation and Equity were significant independent predictors of Self-Regulation.

My third research question involving student sex and school location (urban/rural) as determinants of classroom environment and student attitudes involved the use of MANOVA/ANOVAs to ascertain statistical significance and effect sizes (Cohen's *d*) to ascertain the magnitude of differences. The main findings were:

- Sex differences in learning environment perceptions and attitudes were relatively small in magnitude (ranging from 0.08 to 0.32 standard deviations), but were statistically significant for 9 of the 12 scales and were in the same direction for every scale (with males reporting more-positive scores).
- Location differences in learning environment perceptions and attitudes were relatively small (ranging from 0.06 to 0.34 standard deviations), but were statistically significant for 11 of the 12 scales and were in the same direction for every scale (with urban students reporting more-positive scores).

5.3 SIGNIFICANCE

My study has practical, methodological and substantive significance. A main practical implication for policy-makers and educators is that my findings of associations between students' attitudes to science and the nature of classroom learning environments suggest ways to promote more positive student attitudes through changing classroom environments to give more emphasis to constructs in the WIHIC (e.g. Task Orientation, Equity). Also my finding that males and urban students reported more-positive attitudes and classroom environment perceptions than, respectively, females and rural students reinforces well-known educational inequities in Afghanistan that need to be addressed.

It is methodologically significant that my research involved successfully modifying, translating into Dari and validating a version of widely-applicable and economical learning environment scales (WIHIC) and attitude scales (Enjoyment and SALES). Those scales now can be used by others in a variety of research and practical applications in Afghanistan.

As the first learning environment study ever conducted in Afghanistan, my research makes a substantive contribution to the field of classroom learning environments. Therefore, this study adds to the large body of existing knowledge about the assessment, effects and determinants of learning environments in many other countries.

5.4 LIMITATIONS

Even though planning for data collection was thorough and every reasonable precaution was taken, inevitably some limitations are likely to exist in all educational research. Whenever questionnaires are used, it is possible that some students have difficulties in reading and understanding some items. Although I took numerous precautions (modifying some items, careful translation and back-translation, and a pilot study), difficulties in comprehending questionnaire items among some students could have been a limitation in my study.

In all educational research, there are unavoidable limitations related to the sample. Fortunately, my relatively large sample size of 1619 students would be associated with high statistical power for statistical significance testing. However, given the difficulties in gaining access to school, I did not have the luxury of selecting a random or even representative sample of all schools in Afghanistan. Therefore, the results from my sample should only be generalised to a broader group with caution.

Although researcher bias is always a potential threat in all educational research, this was reduced in my study because of my familiarity with the Afghani culture. As explained in Section 1.3, I was born in Afghanistan, was educated at the primary and secondary levels in Afghanistan, and worked in schools in Afghanistan. This was a distinct advantage in my study when I administered all questionnaire personally. Additionally, I am a fluent speaker of the two languages (Dari and Pashto) spoken by students in my sample.

Another limitation was that using qualitative methods (e.g. observations and interviews) was beyond the scope and resources of my research. In the light of the serious difficulties in Afghanistan in gaining access to schools and in travel (see Sections 3.5.1 and 3.5.2), it was not practically feasible to attempt qualitative data collection. Tobin and Fraser (1998) have elaborated the considerable benefits of combining qualitative and quantitative data collection methods in learning environment research. It is likely that qualitative information would have been useful for embellishing, explaining and triangulating findings based on quantitative questionnaire methods.

The types of statistical analysis used in my research were adequate for this pioneering study in Afghanistan. In the future, however, perhaps more sophisticated analyses might also be used. For example, exploratory factor analyses could be complemented by confirmatory factor analyses. Because the correlation and multiple regression analyses used to investigate relationships between student attitudes and the learning environment could only detect linear relationships, any non-linear relationships would have been missed. Multilevel analysis could be used to accommodate the way in which students are nested within classes, whereas structural equation modeling (SEM) might also be used to model relationships between classroom environment, its determinants (student sex and school location) and student attitudes.

5.5 SUGGESTIONS FOR FUTURE RESEARCH

Given that this research was the first learning environment study in Afghanistan, the scope for future research in this country is very large. Some of the following suggested lines of research grow out of the shortcomings of my study as identified in Section 5.4:

- Replicate my study with other samples of science students in order to increase the generalisability of findings
- Extend my study by using different learning environment questionnaires (e.g. Constructivist Learning Environment Survey, CLES; Science Laboratory Environment Inventory, SLEI).
- Extend my study's range of student outcome variables beyond attitudes to include a range of cognitive outcomes (especially achievement), psychomotor outcomes, mental health, etc.
- Extend my study in high-school science education to other subject areas and educational levels
- Extend my study's determinants of learning environments beyond student gender and school location to include other independent variables such as grade level, teacher gender, socioeconomic status, etc.
- Include teachers' perceptions as well as students' perceptions of learning environments
- Combine quantitative and qualitative research methods in learning environment research as recommended by Tobin and Fraser (1998)
- Use more sophisticated methods of data analysis such as confirmatory factor analysis, structural equation modeling (SEM) and multilevel analysis.

In addition, there is considerable scope to extend to Afghanistan some of the lines of past learning environment research reviewed by Fraser (2014), including:

- evaluation of educational programs (see Section 2.4.2)
- school psychology (Burden & Fraser, 1983)
- teacher action research aimed at improving classroom environments (see Section 2.4.3), which is practically feasible because the prevailing climate in Afghanistan allows teachers to involve themselves in attempts to improve their teaching
- cross-national studies (see Section 2.4.4)
- investigation of differences between students' and teachers' perceptions and between perceptions of actual and preferred classroom environment (Fisher & Fraser, 1983)
- links between the environments of the classroom, school and home (Fraser & Kahle, 2007)
- investigation of whether students achieve better in their preferred classroom environments (Fraser & Fisher, 1983b).

5.6 CHAPTER CONCLUSION

In Afghanistan, there is enormous scope to improve the overall quality of education, to reduce educational inequities (e.g. among females and students in rural schools) and to expand the quite limited amounts and types of educational research being undertaken. Hopefully the present pioneering study of learning environments (the first ever in Afghanistan) not only will promote awareness of the importance of the learning environment among teachers and researchers, but also will motivate other researchers

to investigate its assessment, effects and determinants and inspire teachers to create more-positive classroom environments for their students.

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APPENDIX A

English Version of Learning Environment and Attitude Scales

Items 1–56	Seven WIHIC (What Is Happening In this Class?) Scales
Items 57–64	Enjoyment of Science Lessons/Attitude to Subject Scale
Items 65–96	Four SALES (Students' Adaptive Learning Engagement in Science) Scales

Note: Although students provided responses to both an actual and a preferred form of the WIHIC, only data for the actual form are reported and analysed in this thesis.

Footnote The WIHIC was developed by Fraser, Fisher and McRobbie (1996) and is discussed in this thesis in Sections 2.3.8 and 3.4.1. It was used in my study and included in this thesis with the permission of the authors.

The Enjoyment of Science Lessons scale was developed by Fraser (1981b) and is discussed in this thesis in Sections 2.5.1 and 3.4.2. It was used in my study and included in this thesis with the permission of the authors.

The SALES was developed by Velayutham, Aldridge and Fraser (2011) and is discussed in this thesis in Sections 2.5.2 and 3.4.3. It was used in my study and included in this thesis with the permission of the authors.

What Is Happening In this Class?

(WIHIC)

Directions for Students

This questionnaire contains statements about practices that could take place in your class. You will be asked how often each practice takes place. The 'Actual' column is to be used to describe how often each practice actually takes place in this class. The 'Preferred' column is to be used to describe how often you would like each practice to take place (a wish list).

There are no 'right' or 'wrong' answers. Your opinion is what is wanted. Your responses will be confidential.

For each statement, draw a circle around

1 if you **ALMOST NEVER** feel this way in class.
2 if you **SELDOM** feel this way in class.
3 if you **SOMETIMES** feel this way in class.
4 if you **OFTEN** feel this way in class.
5 if you **ALMOST ALWAYS** feel this way in class

For example

	Almost Never	**Seldom**	**Some-times**	**Often**	**Almost Always**
1. Learning science is fun	1	2	3	4	(5)

		ACTUAL					PREFERRED				
	Student Cohesiveness	Almost Never	Seldom	Some times	Often	Almost Always	Almost Never	Seldom	Some times	Often	Almost Always
1.	I make friends among students in this class.	1	2	3	4	5	1	2	3	4	5
2.	I know other students in this class.	1	2	3	4	5	1	2	3	4	5
3.	I am friendly to members of this class.	1	2	3	4	5	1	2	3	4	5
4.	Members of the class are my friends.	1	2	3	4	5	1	2	3	4	5
5.	I work well with other class members.	1	2	3	4	5	1	2	3	4	5
6.	I help other class members who are having trouble with their work.	1	2	3	4	5	1	2	3	4	5
7.	Students in this class like me.	1	2	3	4	5	1	2	3	4	5
8.	In this class, I get help from other students.	1	2	3	4	5	1	2	3	4	5
	Teacher Support	Almost Never	Seldom	Some times	Often	Almost Always	Almost Never	Seldom	Some times	Often	Almost Always
9.	The teacher takes a personal interest in me.	1	2	3	4	5	1	2	3	4	5
10.	The teacher goes out of his/her way to help me.	1	2	3	4	5	1	2	3	4	5
11.	The teacher considers my feelings.	1	2	3	4	5	1	2	3	4	5
12.	The teacher helps me when I have trouble with the work.	1	2	3	4	5	1	2	3	4	5
13.	The teacher talks with me.	1	2	3	4	5	1	2	3	4	5
14.	The teacher is interested in my problems.	1	2	3	4	5	1	2	3	4	5
15.	The teacher moves about the class to talk with me.	1	2	3	4	5	1	2	3	4	5
16.	The teacher's questions help me to understand.	1	2	3	4	5	1	2	3	4	5

		ACTUAL					PREFERRED				
	Involvement	Almost Never	Seldom	Some times	Often	Almost Always	Almost Never	Seldom	Some times	Often	Almost Always
17.	I discuss ideas in class.	1	2	3	4	5	1	2	3	4	5
18.	I give my opinions during class discussions.	1	2	3	4	5	1	2	3	4	5
19.	The teacher asks me questions.	1	2	3	4	5	1	2	3	4	5
20.	My ideas and suggestions are used during classroom discussions.	1	2	3	4	5	1	2	3	4	5
21.	I ask the teacher questions.	1	2	3	4	5	1	2	3	4	5
22.	I explain my ideas to other students.	1	2	3	4	5	1	2	3	4	5
23.	Students discuss with me how to go about solving problems.	1	2	3	4	5	1	2	3	4	5
24.	I am asked to explain how I solve problems.	1	2	3	4	5	1	2	3	4	5
	Task Orientation	Almost Never	Seldom	Some times	Often	Almost Always	Almost Never	Seldom	Some times	Often	Almost Always
25.	Getting a certain amount of work done is important to me.	1	2	3	4	5	1	2	3	4	5
26.	I do as much as I set out to do.	1	2	3	4	5	1	2	3	4	5
27.	I know the goals for this class.	1	2	3	4	5	1	2	3	4	5
28.	I am ready to start this class on time.	1	2	3	4	5	1	2	3	4	5
29.	I know what I am trying to accomplish in this class.	1	2	3	4	5	1	2	3	4	5
30.	I pay attention during this class.	1	2	3	4	5	1	2	3	4	5
31.	I try to understand the work in this class.	1	2	3	4	5	1	2	3	4	5
32.	I know how much work I have to do.	1	2	3	4	5	1	2	3	4	5
	Investigation	Almost Never	Seldom	Some times	Often	Almost Always	Almost Never	Seldom	Some times	Often	Almost Always
33.	I carry out investigations to test my ideas.	1	2	3	4	5	1	2	3	4	5
34.	I am asked to think about the evidence for statements.	1	2	3	4	5	1	2	3	4	5

		ACTUAL					PREFERRED				
35.	I carry out investigations to answer questions coming from discussions.	1	2	3	4	5	1	2	3	4	5
36.	I explain the meaning of statements, diagrams and graphs.	1	2	3	4	5	1	2	3	4	5
37.	I carry out investigations to answer questions that puzzle me.	1	2	3	4	5	1	2	3	4	5
38.	I carry out investigations to answer the teacher's questions.	1	2	3	4	5	1	2	3	4	5
39.	I find out answers to questions by doing investigations.	1	2	3	4	5	1	2	3	4	5
40.	I solve problems by using information obtained from my own investigations.	1	2	3	4	5	1	2	3	4	5
	Cooperation	Almost Never	Seldom	Some times	Often	Almost Always	Almost Never	Seldom	Some times	Often	Almost Always
41.	I cooperate with other students when doing assignment work.	1	2	3	4	5	1	2	3	4	5
42.	I share my books and resources with other students when doing assignments.	1	2	3	4	5	1	2	3	4	5
43.	When I work in groups in this class, there is teamwork.	1	2	3	4	5	1	2	3	4	5
44.	I work with other students on projects in this class.	1	2	3	4	5	1	2	3	4	5
45.	I learn from other students in this class.	1	2	3	4	5	1	2	3	4	5
46.	I work with other students in this class.	1	2	3	4	5	1	2	3	4	5
47.	I cooperate with other students on class activities.	1	2	3	4	5	1	2	3	4	5
48.	Students work with me to achieve class goals.	1	2	3	4	5	1	2	3	4	5

		ACTUAL					PREFERRED				
	Equity	Almost Never	Seldom	Some times	Often	Almost Always	Almost Never	Seldom	Some times	Often	Almost Always
49.	The teacher gives as much attention to my questions as to other students' questions.	1	2	3	4	5	1	2	3	4	5
50.	I get the same amount of help from the teacher as do other students.	1	2	3	4	5	1	2	3	4	5
51.	I have the same amount of say in this class as other students.	1	2	3	4	5	1	2	3	4	5
52.	I am treated the same as other students in this class.	1	2	3	4	5	1	2	3	4	5
53.	I receive the same encouragement from the teacher as other students do.	1	2	3	4	5	1	2	3	4	5
54.	I get the same opportunity to contribute to class discussions as other students.	1	2	3	4	5	1	2	3	4	5
55.	My work receives as much praise as other students' work.	1	2	3	4	5	1	2	3	4	5
56.	I get the same opportunity to answer questions as other students.	1	2	3	4	5	1	2	3	4	5

	Attitude to Subject	Almost Never	Seldom	Some times	Often	Almost Always
57.	I look forward to lessons in this subject.	1	2	3	4	5
58.	Lessons in this subject are fun.	1	2	3	4	5
59.	I dislike lessons in this subject.	1	2	3	4	5
60.	Lessons in this subject bore me.	1	2	3	4	5
61.	This subject is one of the most interesting school subjects.	1	2	3	4	5
62.	I enjoy lessons in this subject.	1	2	3	4	5
63.	Lessons in this subject are a waste of time.	1	2	3	4	5
64.	These lessons make me interested in this subject.	1	2	3	4	5

Learning Goal Orientation	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
In this science class …					
65. One of my goals is to learn new concepts.	1	2	3	4	5
66. One of my goals is to learn as much as I can.	1	2	3	4	5
67. One of my goals is to master new science skills	1	2	3	4	5
68. It is important that I understand my work.	1	2	3	4	5
69. It is important that I improve my science skills.	1	2	3	4	5
70. It is important for me to learn the science content that is taught.	1	2	3	4	5
71. Understanding science ideas is important to me.	1	2	3	4	5
72. It is important that I understand what is being taught to me.	1	2	3	4	5
Performance Orientation	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
In this science class …					
73. It is important that other students think I am good at my class work.	1	2	3	4	5
74. It is important that I do well in science tests.	1	2	3	4	5
75. I want to show others that I am good at my work.	1	2	3	4	5
76. It is important that I do well in assignments and projects.	1	2	3	4	5
77. It is important that I earn good grades.	1	2	3	4	5
78. I want other students think that I am clever.	1	2	3	4	5
79. I want to show others science work is easy for me.	1	2	3	4	5
80. Getting a good grade is satisfying.	1	2	3	4	5

Task Value		Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
In this science class, …						
81.	The science I learn can be used in my daily life.	1	2	3	4	5
82.	The science I learn stimulates my thinking.	1	2	3	4	5
83.	The science I learn satisfies my curiosity.	1	2	3	4	5
84.	The science I learn is helpful to me.	1	2	3	4	5
85.	The science I learn is relevant to me.	1	2	3	4	5
86.	The science I learn is of practical value.	1	2	3	4	5
87.	The science I learn is interesting.	1	2	3	4	5
88.	The science I learn is useful for me to know.	1	2	3	4	5
Self-Regulation		***Strongly Disagree***	***Disagree***	***Not Sure***	***Agree***	***Strongly Agree***
In this science class …						
89.	Even when tasks are uninteresting, I keep working.	1	2	3	4	5
90.	I work hard even if I do not like what I am doing.	1	2	3	4	5
91.	I get myself to learn even when there are other better things to do.	1	2	3	4	5
92.	I concentrate so that I won't miss important points.	1	2	3	4	5
93.	I finish my work and assignments on time.	1	2	3	4	5
94.	I don't give up even when the work is difficult.	1	2	3	4	5
95.	I concentrate to remember information presented in class.	1	2	3	4	5
96.	I never quit until I finish what I am supposed to do.	1	2	3	4	5

APPENDIX B

Dari Version of Learning Environment and Attitude Scales

پرسشنامه پیرامون ارزیابی سیستم تعلیمی درافغانستان

WIHIC

Personal Particulars

(مشخصا ت شخصی)

Class Number **اینجا را دست نزنید. صرف برای استفاده تحقیق کننده میباشد.**

(ا سم)

(نا م مکتب)

(بیالوژی)		(کیمیا)		(فزیک)	(مضامین)	

		(عمر)

	(مونث)		(مذکر)	(جنسیت)	

Please tick (✓) the correct response.

کدام سویه هایی تحصیلی را میخواهید بدست آورید؟

(Tick (✓) only ONE) **از این سمبول (✓) در انتخاب تان استفاده**

	صرف دوره متوسطه را میخواهم تکمیل کنم
	علاوه بر مکتب متوسطه یک مکتب مسلکی را هم میخواهم تکمیل کنم
	میخواهم یک دوره مسلکی صنفی را هم تکمیل کنم
	کم از کم فارغ گدام دانشگاه شوم
	از کدام بوهنتون با دیبلوم لسانس فارغ شوم
	از کدام دانشگاه با دیبلوم ماستری و یا دوکتورا فارغ شوم

در این صنف چی میگذرد؟

(WIHIC

(هدایات برای محصلین جهت تکمیل نمودن این فورمه)

این سوالیه ها مو ضو عاتی را در بر دارند که ممکن ا ست در صنف شما صورت کیرد. از شما سوال خواهد شد که این مو ضو عات چند مرتبه در صنف صورت میگیرد. ستون داده شده باید برای تشریح موضوع استفاده شود.
ستون ترجیح داده شده برای این است که شما تشریح کنید که چند مرتبه باید صورت گیرد.

جواب ها (در این پرسشنامه) نمیتوانند صحیح ویا غلط با شند. تنها نظر شما (در باره موضوع ارایه شده)دریتجا خواسته شده است. نظریات شما از محر میت برخور دار خواهد بود.

بر ای انتخاب هر جواب یک د ایره به دور عدد انتخا بی تان بکشید.

1 این عدد را انتخاب کنید اگر احساس میکنید این موضوع **تقریباهیچگا** صورت نمیگیرد

2 این عدد را انتخاب کنید اگر احساس میکنید این موضوع **ندرتا** صورت میگیرد

3 این عدد را انتخاب کنید اگر احساس میکنید این موضوع **بعضی اوقا ت** صورت میگیرد

4 این عدد را انتخاب کنید اگر احساس میکنید این موضوع **اکثرا** صورت میگیرد

5 این عذ ذ را انتخاب کنید اگر احساس میکنید این موضوع **تقریبا همیشه** صورت میگیرد

به طور مثا ل:

	Almost Never	Seldom	Some-Times	Often	Almost Always
اُموزش ساینس دلخوشی بار می اورد	1	2	3	4	(5)

درجه ایکه ترجیح داده میشود	**درجه واقعی**

	درجه نزدیکی شاگردان	تقریبا هیچ گاه	ندرتا	بعضی اوقات	اکثرا	تقریبا همیشه	تقریبا هیچ گاه	ندرتا	بعضی اوقات	اکثرا	تقریبا همیشه
1.	**من در این صنف از شاگردان رفقا میسازم**	1	2	3	4	5	1	2	3	4	5
2.	**من شاگردان دیگر این صنف را میشناسم**	1	2	3	4	5	1	2	3	4	5
3.	**من با اعضای این صنف رفیقانه هستم**	1	2	3	4	5	1	2	3	4	5
4.	**اعضای صنف رفقای من هستند**	1	2	3	4	5	1	2	3	4	5
5.	**من با اعضای دیگر صنف خوب کار میکنم**	1	2	3	4	5	1	2	3	4	5
6.	**من اعضای صنف ر ا که مشکلات دارند کمک مینما یم**	1	2	3	4	5	1	2	3	4	5
7.	**شاگردان این صنف مرا خوش دارند**	1	2	3	4	5	1	2	3	4	5
8.	**درین صنف من از شاگردان دیگر کمک گرفته میتوانم**	1	2	3	4	5	1	2	3	4	5
	حما یت معلم	تقریبا هیچ گاه	ندرتا	بعضی اوقات	اکثرا	تقریبا همیشه	تقریبا هیچ گاه	ندرتا	بعضی اوقات	اکثرا	تقریبا همیشه
9.	**معلم یک علاقه شخصی به من دارد**	1	2	3	4	5	1	2	3	4	5
10.		1	2	3	4	5	1	2	3	4	5

	معلم/معلمه از حد خود بیشتر به من کمک مینماید										
11.	**معلم احساسات مرا مد نظر میکیرد**	1	2	3	4	5	1	2	3	4	5
12.	**معلم زمانیکه من مشکل کاری داشنه باشم مرا کمک میککند**	1	2	3	4	5	1	2	3	4	5
13.	**معلم با من صحبت میکند**	1	2	3	4	5	1	2	3	4	5
14.	**معلم در مشکلات من علا قمند هست**	1	2	3	4	5	1	2	3	4	5
15.	**معلم در اطراف صنف حرکت میکند تا با من صحبت کند**	1	2	3	4	5	1	2	3	4	5
16.	**سوالات معلم مرا در ادراک درس کمک میکند**	1	2	3	4	5	1	2	3	4	5

		ACTUAL					**PREFERRED**				
	امتزاج با شاگردان درحین تذریس	تقریبا هیچ گا	ندرتا	بعضی اوقات	اکثرا	تقریبا همیشه	تقری با هیچ گا	ندرتا	بعضی اوقات	اکثرا	تقریبا همیشه
17.	**من مفکوره های خود را در صنف بحث میتوانم**	1	2	3	4	5	1	2	3	4	5
18.	**من نظریات خود را حین بحث صنفی ارایه میکنم**	1	2	3	4	5	1	2	3	4	5
19.	**معلم از من (در صنف) سوال ها میکند**	1	2	3	4	5	1	2	3	4	5
20.	**مفکوره ها و نظریات من در حین مباحثات صنفی مورد استفاده قرار میگیرد**	1	2	3	4	5	1	2	3	4	5

21.	**من از معلم سوال ها کرده میتوانم**	1	2	3	4	5	1	2	3	4	5
22.	**من مفکوره های خودرا به شاگردان دیگر تشریح کرده میتوانم**	1	2	3	4	5	1	2	3	4	5
23.	**شاگردان در باره طرق حل سوالات با من بحث کرده میتوانند**	1	2	3	4	5	1	2	3	4	5
24.	**راجع به حل سوالات از من هم استجواب میشود**	1	2	3	4	5	1	2	3	4	5
	استشراق وظا یف	تقریبا هیچ گا	ندرتا	بعض ی اوق ات	اکث را	تقریبا همیشه	r تقری با هیچ گا	ندر تا	بعضی اوقات	اکث را	تقریبا همیشه
25.	**یک مقدار کار که اجرا شود برای من از اهمیت برخوردار هست**	1	2	3	4	5	1	2	3	4	5
26.	**من همانقدر که کار کرده میتوانم به ان می پردازم**	1	2	3	4	5	1	2	3	4	5
27.	**من اهداف ا ین صنف را میدانم که چیست**	1	2	3	4	5	1	2	3	4	5
28.	**من همیشه اماده ام که صنف خود را به وقت آن شروع نمابم**	1	2	3	4	5	1	2	3	4	5
29.	**من میدادنم که جی وظایف را درین صنف انجام دهم**	1	2	3	4	5	1	2	3	4	5
30.	**من در جریان صنف متوجه همه چیز ها میباشم**	1	2	3	4	5	1	2	3	4	5
31.		1	2	3	4	5	1	2	3	4	5

	من میکوشم تا کاری که در صنف انجام میشود خوب درک نمایم										
32.	**من میدانم که تا چه اندازه کار را باید انجام دهم**	1	2	3	4	5	1	2	3	4	5
	تفحص	تقریبا هیچ گا	ندرتا	بعض ی اوقات	اکث را	تقریبا همیشه	تقری با هیچ گا	ندر تا	بعضی اوقات	اکث را	تقریبا همیشه
33.	**من تفحصات خود را پیرامون مفکوره ها یم امتحان مینما یم**	1	2	3	4	5	1	2	3	4	5
34.	**به من توصیه شده است تا فکر کنم آنچه میگویم مدلل باشد**	1	2	3	4	5	1	2	3	4	5
35.	**من تفحصات خود را چنین انجام میدهم تا به سوالاتی که در جریان بحث پیدا میشود جوابی داشته باشم**	1	2	3	4	5	1	2	3	4	5
36.	**من معنای جملاتی را که میگویم یا گراف و دیاگرامی ر ا که ارایه میکنم خوب تشریح مبنمایم تا چیزی مبهم نماند**	1	2	3	4	5	1	2	3	4	5
37.	**من تفحص خود را تا اندازه ای دوام میدهم تا به سوالاتی که شکل معمایی را به خود میگیرد جوابی داشته باشم**	1	2	3	4	5	1	2	3	4	5
38.	**من تفحص خود را تا اندازه ای دوام میدهم تا سوالات معلم را جواب داده بتوانم**	1	2	3	4	5	1	2	3	4	5
39.	**من از طریق تفحص نمودن به سوالات جواب پیدا میکنم**	1	2	3	4	5	1	2	3	4	5

40. **من با استفاده از معلوماتی که از طریق تفحص نمودن پیدا کرده ام به حل سوالات می پردازم**	1	2	3	4	5	1	2	3	4	5

		ACTUAL					PREFERRED				
	همکاری	تقریبا هیچ گا	ندرتا	بعضی اوقات	اکثرا	تقریبا همیشه	تقریبا هیچ گا	ندرتا	بعضی اوقات	اکثرا	تقریبا همیشه
41.	**من با شاگردان دیگر در پرداختن به کارهای توظیف شده همکاری مینمایم**	1	2	3	4	5	1	2	3	4	5
42.	**در وقت پرداختن به کارهای توظیف شده من کتابها و منابع دست داشته خود را با شاگردان دیگر شریک میسازم**	1	2	3	4	5	1	2	3	4	5
43.	**زمانیکه من با گروپ های صنفی کار میکنم کار ار طریق تیم های کاری پیش میرود**	1	2	3	4	5	1	2	3	4	5
44.	**من با شاگردان دیگر بالای پروژه ها درین صنف کار میکنم**	1	2	3	4	5	1	2	3	4	5
45.	**من درین صنف از شاگردان دیگر هم می آموزم**	1	2	3	4	5	1	2	3	4	5
46.	من **با شاگردان دیگر درین صنف کار میکنم**	1	2	3	4	5	1	2	3	4	5
47.	**در فعالیت های با همی صنفی من با شاگردان دیگر همکاری مینمایم**	1	2	3	4	5	1	2	3	4	5
48.	**شاگردان بامن یکجا کار میکنند تا اهداف مشترک صنفی را بر آورده نماییم**	1	2	3	4	5	1	2	3	4	5
	رویه منصفانه	تقریبا هیچ گا	ندرتا	بعضی اوقات	اکثرا	تقریبا همیشه	تقریبا هیچ گا	ندرتا	بعضی اوقات	اکثرا	تقریبا همیشه

49.	**معلم همانقدر در سوالات من توجه میکند که در سوالات دیگر شاگردان توحه مینماید**	1	2	3	4	5	1	2	3	4	5
50.	**من همانقدر کمک از معلم بدست می آورم که دیگر شاگردان از او بدست می آورند**	1	2	3	4	5	1	2	3	4	5
51.	**من همانقدر حق اظهارنظر درین صنف دارم که دیگر شاگردان دارند**	1	2	3	4	5	1	2	3	4	5
52.	**بامن درینصنف همان طور رفتار نیک میشود که با شاگردان دیگر صورت میگیرد**	1	2	3	4	5	1	2	3	4	5
53.	**از معلم همانقدر تشویق میرسد که ذیگر شاکردان تشویق میشوند**	1	2	3	4	5	1	2	3	4	5
54.	**من همانقدر فرصت سهم گیری در بحث های صنفی دارم که دیگر شاگردان دارند**	1	2	3	4	5	1	2	3	4	5
55.	**کار من همانقدر مورد توصیف قزار میگیر که از دیگر شاگردان توصیف میشود**	1	2	3	4	5	1	2	3	4	5
56.	**به من همانقدر فرصت جواب دادن به سوالات داده میشود که به دیگر شاگردان فرصت داد ه میشود**	1	2	3	4	5	1	2	3	4	5

طرق برخورد شاگردان با مضامین	تقریبا هیچگا	ندرتا	بعضی اوقات	اکثرا	تقریبا همیشه
57. **من خوشبین به درسهای این مضمون هستم**	1	2	3	4	5
58. **درسها درین مضمون باعث دلخوشی هست**	1	2	3	4	5
59. **من درسهای این مضمون را خوش ندارم**	1	2	3	4	5
60. **درسهای این مضمون مرا خسته میسازد**	1	2	3	4	5

61. **ا ین مضمون یکی از دلچسب ترین مضامین مکتب است**	1	2	3	4	5
62. **من از درس های این مضمون لذت می برم**	1	2	3	4	5
63. **درس ها درین مضمون ضیاع وقت میبا شند**	1	2	3	4	5
64. **این درس ها مرا علاقمند درین مضمون میسا زند**	1	2	3	4	5

استشراق به اهداف آموزش	من قویآ موافقه ندارم	موافق نیستم	متیقن نمیباشم	موافق هستم	قویآ موافق هستم
درین صنف مضمون ساینس.....					
65. یکی از اهداف من اینست تا مفکوره های جدید را بیا موزم	1	2	3	4	5
66. **یکی از اهداف من این است تا هر قدر بتوانم بیا موزم**	1	2	3	4	5
67. یکی از اهداف من این است تا خردمند در علو م جدید سا ینس شوم	1	2	3	4	5
68. این برای من مهم است تا کار ی که میکنم انرا خوب بدانم	1	2	3	4	5
69. این برای من مهم است تا مها رت های سا ینسی خود را عا لی تر و بهتر تر بسازم	1	2	3	4	5
70. این برای من مهم است تا محتو یا ت ساینس را که تدریس می شود یاد بگیرم	1	2	3	4	5
71. دانستن مفکوره های سا ینس برای من مهم هست	1	2	3	4	5
72. این مهم است تا انچه به من تدر یس شدده است درک خوب از آن داشته باشم	1	2	3	4	5
استشراق پیرامون اجرای کار	من قویآ موافقه ندارم	موافق نیستم	متیقن نمیباشم	موافق هستم	قویآ موافق هستم
73. این مهم هست که شاگردان فکر کنند که من در کار های صنفی خودم خوب هستم	1	2	3	4	5
74. این مهم است که من در امتحانات ساینس نتیجه خوب بگیرم	1	2	3	4	5
75. من میخواهم بد یگران نشان دهم که من در کار های خود موفق هستم	1	2	3	4	5

76. این مهم است که من در پروژه ها و وظایف محوله موفق باشم	1	2	3	4	5
77. این مهم است که من نمرا ت خوب کمایی کنم	1	2	3	4	5
78. من میخواهم که دیگر شاگردان فکر کنند که من زیرک و هوشیار هستم	1	2	3	4	5
79. من میخواهم بدیگران نشان دهم که کارهای ساینس برای من اسان هست	1	2	3	4	5
80. بدست آوردن نمرات خوب اقناع کننده میباشد	1	2	3	4	5

ارزشمندی وظیفه	من قویآ موافقه ندارم	موافق نیستم	متیقن نمیباشم	موافق هستم	قویآ موافق هستم
81. ساینسی را که من می اموزم در زندگی روزانه میتوان از ان استفاده نمود	1	2	3	4	5
82. ساینسی که من می اموزم قوای ذهنی مرا تحریک میکند	1	2	3	4	5
83. ساینسی که من می اموزم تعجب مرا اقناع کننده میباشد	1	2	3	4	5
84. ساینسی را که من می اموزم کمک کننده به من میباشد	1	2	3	4	5
85. ساینسی که من می اموزم در امور زندگی سر و کار دارد	1	2	3	4	5
86. ساینسی که من می اموزم ارزش عملی دارد	1	2	3	4	5
87. ساینسی که من می اموزم دلچسب میباشد	1	2	3	4	5
88. ساینسی که من می اموزم دانستن ان برای من مفید است	1	2	3	4	5

تنظیم خودی	من قویآ موافقه ندارم	موافق نیستم	متیقن نمیباشم	موافق هستم	قویآ موافق هستم
...درین صنف درسی ساینس.....					
89. حتی وقتیکه وظیفه دلچسب هم نباشد من کار را دوام میدهم	1	2	3	4	5
90. من در کار کوشش میکنم گر چه کار مورد نظر را خوش نداشته باشم	1	2	3	4	5
91. من اموزش خود را پیش می برم با وجودیکه کار های دیگر را باید انجام دهم	1	2	3	4	5
92. من از دقت کار میگیرم تا نکات مهم را خطا نکنم	1	2	3	4	5
93. من کار های توظیف شده خود را بوقت و زمان ان انجام میدهم	1	2	3	4	5
94. من کار را ترک نمیکنم زمانی که کار مشکل باشد	1	2	3	4	5
95. من دقت میکنم تا معلومات فرا گرفته صنفی رابه خاطر داشته باشم	1	2	3	4	5
96. من از کار گریز نمیکنم تا کاری را که با ید انجام دهم خلاص نکرده باشم	1	2	3	4	5

APPENDIX C

Ethics Approval from Curtin University's Human Research Ethics Committee

(SMEC-17-10, 7 May 2010)

memorandum

Curtin University of Technology

To	Sayed Anwar shah Wafiq, SMEC
From	Pauline Howat, Coordinator for Human Research Ethics, Science and Maths Education Centre
Subject	Protocol Approval **SMEC-17-10**
Date	7 May 2010
Copy	Jill Aldridge, SMEC

Office of Research and Development

Human Research Ethics Committee

TELEPHONE 9266 2784
FACSIMILE 9266 3793
EMAIL hrec@curtin.edu.au

Thank you for your "Form C Application for Approval of Research with Minimal Risk (Ethical Requirements)" for the project titled "*HOW ARE GIRLS FARING IN HIGH SCHOOL SCIENCE CLASSES IN AFGHANISTAN?: LEARNING ENVIRONMENTS AND ATTITUDES*". On behalf of the Human Research Ethics Committee I am authorised to inform you that the project is approved.

Approval of this project is for a period of twelve months **30th April 2010** to **29th April 2011**.

If at any time during the twelve months changes/amendments occur, or if a serious or unexpected adverse event occurs, please advise me immediately. The approval number for your project is **SMEC-17-10**. *Please quote this number in any future correspondence.*

Pauline

PAULINE HOWAT
Coordinator for Human Research Ethics
Science and Maths Education Centre

Please Note: The following standard statement must be included in the information sheet to participants: *This study has been approved by the Curtin University Human Research Ethics Committee (Approval Number SMEC-17-10). If needed, verification of approval can be obtained either by writing to the Curtin University Human Research Ethics Committee, c/- Office of Research and Development, Curtin University of Technology, GPO Box U1987, Perth, 6845 or by telephoning 9266 2784.*

APPENDIX D

Information and Consent Forms

Curtin University of Technology
Science and Mathematics Education Centre

Students' Information Sheet

Dear Student

My name is Sayed Anwar shah Wafiq. I am currently completing a piece of research at the Science and Mathematics Education Centre at Curtin University of Technology.

Purpose of Research
I am investigating how students are faring in high school science classes in Afghanistan in terms of their attitudes and perceptions of the learning environment.

Your Role
I am interested in finding out about your opinions about your school and class learning environment and how it influences your attitudes. I will use questionnaires that will take 15 minutes to answer. I may also ask for your participation in a short interview about your attitudes and opinions about your teacher. Again this participation will be voluntary and of short duration (10-15 mins).

Consent to Participate
Your involvement in the research is entirely voluntary. You have the right to withdraw at any stage of the research 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 allow me to use your data in this research.

Confidentiality
The information you provide will be kept separate from your personal details, and only myself and my supervisor will have access to this. Questionnaires will not have your name or any other identifying information in adherence to university policy, and all information will be kept in a locked cabinet for at least five years, before a decision is made as to whether it should be destroyed.

Further Information
This research has been reviewed and given approval by Curtin University of Technology Human Research Ethics Committee (Approval Number #SMEC-17-10). If you would like further information about the study, please feel free to contact me on 0407701678 or by e-mail sayed-5@hotmail.com or, alternatively, you can contact my supervisor: Dr Jill Aldridge by e-mail J.Aldridge@curtin.edu.au. Thank you very much for your considerations on taking parts in this research. Your participation is greatly appreciated.

Your sincerely,

S.A.S.Wafiq

Curtin University of Technology
Science and Mathematics Education Centre

Parents' Information Sheet

Dear Parent

My name is Sayed Anwar Shah Wafiq. I am currently completing a piece of research for my Doctor of Philosophy at Curtin University of Technology. This study meets the requirements of Curtin's Research Ethics Committee.

Purpose of Research
I am investigating the research topic: "Science Classroom Learning Environments in Afghanistan: Assessment, Effects and Deteminants".

Your Role
I will conduct research by asking for your child's opinions regarding the learning environment and how this influences your child's attitudes and efficacy. Your child's teacher and the principal have already been contacted and have agreed in principle to the project. I will use questionnaires that will take 15 minutes to answer. I may also ask for your child's participation in a short interview about his/her attitudes and opinions about the teacher's performance regarding the above. Again this participation will be voluntary and of short duration (10-15 mins).

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

Confidentiality
The information your child provide will be kept separate from her/his personal details, and only myself and my supervisor will have access to this. The questionnaires will not have your child's name or any other identifying information on it in adherence to university policy, and questionnaires will be kept in a locked cabinet for at least five years, before a decision is made as to whether it should be destroyed.

Further Information
This research has been reviewed and given approval by Curtin University of Technology Human Research Ethics Committee (Approval Number #SMEC-17-10). If you would like further information about the study, please feel free to contact me on 0407701678 or by email sayed-5@hotmail.com. Alternatively, you can contact my supervisor: Dr Jill Aldridge by e-mail J.Aldridge@curtin.edu.au. Thank you very much for your considerations on taking parts this research. Your participation is greatly appreciated.

Your sincerely,

SAS.Wafiq

Curtin University of Technology
Science and Mathematics Education Centre

Principals' Information Sheet

Dear Principal

My name is Sayed Anwar Shah Wafiq. I am currently completing a piece of research at the Science and Mathematics Education Centre at Curtin University of Technology. This study will meet the requirements of Curtin's Research Ethics Committee.

Purpose of Research
I am investigating the research topic: "Science Classroom Learning Environments in Afghanistan: Assessment, Effects and Determinants".

Your Role
I am interested in working together with your teachers and students in science classrooms. I would like the students in year 10, 11 and 12 to complete a questionnaire which I would share with you and your teachers beforehand.

Consent to Participate
Your involvement in the research is entirely voluntary. 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 allow me to use your data in this research.

Confidentiality
The information you provide will be kept separate from your personal details, and only myself and my supervisor will only have access to this. Your name or any other identifying information will not be used in adherence to university policy. Student questionnaires will be kept in a locked cabinet for at least five years, before a decision is made as to whether it should be destroyed.

Further Information
This research has been reviewed and given approval by Curtin University of Technology Human Research Ethics Committee (Approval Number #SMEC-17-10). If you would like further information about the study, please feel free to contact me on 0407701678 or by e-mail sayed-5@hotmail.com. Alternatively, you can contact my supervisors: Dr Jill Aldridge (J.Aldridge@curtin.edu.au). Thank you very much for your considerations on taking parts this research. Your participation is greatly appreciated.

Your sincerely,

S.A.S.Wafiq

PRINCIPALS' CONSENT FORM

- I understand the purpose and procedures of the study.
- I have been provided with a participation information sheet.
- I understand that the procedure itself may not benefit me.
- I understand that my involvement is voluntary and I can withdraw at any time without problem.
- I understand that no personal identifying information like my name, address or school 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 understand that updates on the progress of the research will be provided to me.
- I have been given the opportunity to ask questions about this research.
- I agree to participate in the study outlined to me.

Name: _____

Signature: _____

Date: _____

PARENTS' CONSENT FORM

- I understand the purpose and procedures of the study.
- I have been provided with a participation information sheet.
- I understand that the procedure itself may not benefit me and 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, address or school 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 understand that updates on the progress of the research will be provided to me and my child.
- I have been given the opportunity to ask questions about this research.
- I agree that my child may participate in the study.

Name: _____

On Behalf Of……(Child's name)

Signature: _____

Date: _____

STUDENTS' CONSENT FORM

- I understand the purpose and procedures of the study.
- I have been provided with a participation information sheet.
- I understand that the procedure itself may not benefit me.
- I understand that my involvement is voluntary and I can withdraw at any time without a problem.
- I understand that no personal identifying information like my name, address or school 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 understand that updates on the progress of the research will be provided to me.
- I have been given the opportunity to ask questions about this research.
- I agree to participate in the study outlined to me.

Name: _____

Signature: _____

Date: _____

TEACHERS' CONSENT FORM

- I understand the purpose and procedures of the study.
- I have been provided with a participation information sheet.
- I understand that the procedure itself may not benefit me.
- I understand that my involvement is voluntary and I can withdraw at any time without problem.
- I understand that no personal identifying information like my name, address or school 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 understand that updates on the progress of the research will be provided to me.
- I have been given the opportunity to ask questions about this research.
- I agree to participate in the study outlined to me.

Name: _____

Signature: _____

Date: _____