SCIENCE AND MATHEMATICS EDUCATION CENTRE

TRANSITION FROM SENIOR SECONDARY TO HIGHER EDUCATION: A LEARNING ENVIRONMENT PERSPECTIVE

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This thesis is presented as part of the
requirements for the award of the Degree
of Doctor of Philosophy
of
Curtin University of Technology

November 1999

ABSTRACT

The first purpose of this study was to validate a modified and personalised form of the *College and University Classroom Environment Inventory* (CUCEI) and then to use this instrument to examine the actual and preferred classroom environment perceptions of students and instructors at the senior secondary and post secondary levels. A third purpose was to examine students' attitude to their courses on three specific scales, namely, Satisfaction, Difficulty and Speed. A sample of 504 students and 24 instructors from Canada and the Australian Capital Territory completed the CUCEI. The students also responded to an attitudinal questionnaire. Statistical analysis confirmed the reliability of the CUCEI. The Cronbach alpha reliability figures, using the individual student as the unit of analysis, ranged from 0.73 to 0.93 and from 0.76 to 0.94 for the actual and preferred versions respectively. Good alpha reliability figures were also apparent for instructor versions, ranging from 0.72 to 0.90 for the actual version and from 0.72 to 0.93 for the preferred version. When the two levels were compared, students at the higher level had a less favourable perception of their learning environment. Hardly any difference in perceptions was seen in the learning environment between male and female students. There were significant differences in the perceptions of the classroom environment by mature students. Mature students perceived task orientation and equity more favourably than did younger students. Senior secondary students were generally more satisfied with their science courses than post secondary students. There was no difference in their attitude to the speed of delivery of science courses. The sample of 24 instructors generally perceived their environment more favourably than did their students, however, senior secondary instructors viewed the learning environment more favourably than the instructors at the post secondary level. The study also suggests that instructors at the post secondary level are aware of the changes in students' classroom environment and seem to take into account these changes. Qualitative data collected from class observations and student and instructor interviews complemented the quantitative findings of the study.

DEDICATION

This thesis is dedicated to my daughter Ashanthi, the apple of my eyes. She has been the force behind the 'old man' to complete his work.

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CHAPTER 1

INTRODUCTION

This study focuses on the classroom environments of students and teachers in Senior Secondary Schools and the University transfer system in British Columbia, Canada. The study is based in the small northern community of Terrace in British Columbia, where students go from the senior secondary school system to the local community college to begin their studies at the university level. The senior secondary school system in British Columbia is made up of students from grade 10 to grade 12. Students complete their grade 12 studies at the age of about 17 years after which they proceed to either the work force or pursue further studies at the tertiary level either at a college or at one of the four universities in the province. Northwest Community College (NWCC) is part of the College and University education system in British Columbia, Canada, which caters for the tertiary level studies. The college system in British Columbia, apart from offering university level programs is also involved in vocational and business studies. Due to the ever increasing demand for spaces in the universities, the colleges in British Columbia have taken a greater responsibility in offering university courses, in particular for the first two years of a

university science or humanities program. Some colleges have recently been granted degree-granting authority by being designated University colleges.

Generally, students have found the transition from the senior secondary schools to the university system to be problematic. They find it difficult to cope with the increased work loads, the expectation of individualised original work, and the increased speed at which the subject matter is delivered (Killen, 1994; Vahala & Winston, 1994). Given the difficulties faced by students and the expectations of teachers at the two levels of instruction, the senior secondary school and university level, the present research examined the perceptions of the classroom environment from the view point of both the teachers and students. The study also investigated associations between students' perceptions and their attitudes towards science courses with respect to the level of the difficulty of the course and the rate at which the course content is covered. Finally, the study investigated whether there were differences in the learning environment perceptions of boys and girls. The study used both quantitative and qualitative approaches in the collection of data.

1.1 Background of Study

There have been many studies involving the assessment of the learning environment of elementary and secondary classrooms. Within these, there have been some studies into the problems associated with transition from the elementary school level to the secondary school levels (Ferguson & Fraser, 1996; Fraser, 1996; Jarman, 1990; Midgley, Eccles, & Feldlaufer, 1991; Power, 1981). However, few studies have involved university classroom environments (De Young, 1977; Fraser, Treagust, Williamson, & Tobin, 1987; Fraser & Walberg, 1991). This study is significant in that it describes the classroom environment perceptions of students going from their final year at high school to their first year of university study. The study focuses on students in Northern British Columbia, Canada, who after completing their final year in the senior secondary school system move to the local community college to

begin their university studies. Table 1.1 below illustrates the transition rates of students from the senior secondary school system to the post secondary institutes in the respective college region.

Table 1.1
Full Time Transition Rates of Northern British Columbia(BC) High School Graduates Directly into the BC Post Secondary System

College Region	High School Graduates 1994	Direct Entry Full Time Enrolment	Participation Rate (%)
New Caledonia	1,341	465	34.7
North Island	1,105	347	31.4
Northern Lights	465	64	13.8
Northwest	748	240	32.1

Source: Ministry of Advanced Education, Training & Technology (1994). Province of British Columbia (BC).

Numerous senior secondary school students in the city of Terrace, BC attend the local community college, Northwest Community College (NWCC), to gain their associate degree in the sciences or arts. The associate degree is the first two years of the normal four year degree program. Students in this program are termed as 'University Transfer students' because the credits students obtain are transferable to the universities and other institutions within the province and country. In British Columbia, such credits are named 'transfer credits'. This simply means students who successfully complete a course at an accredited institution can transfer the course to another institution to complete their studies. The courses are considered equivalent in standing to the courses at the receiving institution and thus meet all the requirements at the receiving institution to enable the student to continue on to higher level courses. All community colleges have agreements with the public universities and with other colleges regarding acceptance of credits from one to another. Students who successfully complete courses at the college have a choice to transfer these credits either course by course or in blocks to a receiving institution at the end of their first semester or year of study or to complete their second year at the college and obtain an Associate degree. Students who complete the Associate degree

at the college level can transfer into the third year of the science or arts program at either a university or a university college in British Columbia, obtaining full credit for the first two years if the specified minimum grades are achieved in all the courses. For specialised programs such as engineering, students transfer at the end of their first year to the appropriate university.

The student population in the university transfer program at Northwest Community College comes mainly from the senior secondary schools in the region. The bulk of the students come from Terrace itself. Recently, students from the lower mainland (Vancouver and the surrounding areas) have started to come to attend NWCC. Apart from this, the college has attracted several international students over the years.

1.2 Purpose and Significance of the Study

Instructors at the college have observed over the years that their students have perceived the college as an extension of high school. They behaved in the same manner as if they were in their senior high school with their normal 'cliques' and attitudes in the class creating a high school type of atmosphere rather than a university class atmosphere. Some of the faculty members have accepted this and have adopted a teaching style that is a combination of that used in high school and that used in university. This transition phase, which covers semester one of the academic year and runs for 15 weeks, is used to develop the skills and needs of the students to cope with university studies. During this time, some instructors pursue this combined teaching style to allow students time to adapt to the changes that they are expected to make at university level courses. First year studies at the four universities have contained drop out rates of as much as 50% in the first year of studies in the sciences. However, Northwest Community College (NWCC) has had a good 'survival' rate with the above teaching method when students transferred to the universities in the lower mainland of British Columbia.

The study of the classroom environment in the first semester of the university transfer program would be beneficial for the following reasons:

Firstly, educators in the region would have a better insight into the problems students face in coping with changes in their learning environment as a result of their transition from the high school to the university system.

Secondly, it would be beneficial to investigate further the observation by some of the instructors that the first semester at the college appears to be an extension of the high school.

Thirdly, the results would also help instructors at the college to maintain their 'unique' approach to teaching in the program and provide further evidence to the other instructors in the college that a 'guided' approach to teaching in the first semester leads students to a better understanding of their expectations of a real university study program and to increased achievement in science understanding.

Fourthly, the study would benefit the science teachers in the senior secondary schools in Terrace and the surrounding regions, by alerting them to the needs of their students as they progress from one stage of their education to the next.

Fifthly, the results of this study would be an important contribution to science education as they would give an insight in to the difficulties associated with tertiary study by students fresh from the high school system. Hopefully, the results of this study would be used by educators in the field to implement changes in the education system to accommodate the difficulties faced by teachers and students in adjusting to the changes in the learning environment as a result of their movement from the senior secondary school system to post secondary education. Such expectations could possibly, in time, be introduced in professional development programs or teacher education programs both for the senior secondary school and post secondary professionals.

1.3 Research Tools

The study utilises specially modified and updated versions of a personal form of the *College & University Classroom Environment Inventory (CUCEI)* developed by Fraser, Treagust, and Dennis (1986). The personalised form of measuring classroom environment has been shown to yield increased information on differences between individual and groups in classrooms (Fraser, Fisher, & McRobbie, 1996). In addition to this, student attitude, as measured by student satisfaction, difficulty with the course and the rate at which the course content is covered, was assessed with a modified questionnaire based on two scales from the *Learning Environment Inventory (LEI)*, (Fraser, Anderson, & Walberg, 1982; Fraser & Fisher, 1983a) and one scale from the *College & University Classroom Environment Inventory (CUCEI)*, (Fraser, Treagust, & Dennis, 1986; Fraser, Treagust, Williamson, & Tobin, 1987).

1.4 Research Objectives of Study

This study emanates from the field of classroom environment research. The research primarily looks at the classroom environment at the tertiary and upper secondary levels. It focuses on students' and instructors' perceptions of their classroom environments at the senior secondary and post secondary levels. In addition, the study also investigates students' attitudes towards their courses at the two levels. All aspects of this study with respect to student perceptions are also examined on the basis of gender.

Both qualitative and quantitative data were collected for this study. Quantitative data were obtained utilising the instruments outlined in section 1.3 above. Student attitudes were examined with three specific scales selected for this study. The scales were Satisfaction, Difficulty, and Speed of course. Qualitative data were obtained by

a series of interviews with instructors and students as well as by classroom observations.

The objectives of this study are to:

1. develop and validate a personalised form of the College & University Classroom Environment Inventory (CUCEI);

2. use the modified CUCEI to investigate how students at Northwest Community College and at Senior Secondary Schools differ in their perceptions of their classroom environments;

3. investigate if the students' gender and age influences their perceptions of their classrooms;

4. compare how instructors at the college and senior secondary schools perceive their classroom environment;

5. compare the learning environments of the instructors at Northwest Community College (NWCC) who do and do not employ a 'guided' approach to teaching;

6. compare and contrast the degree of difficulty faced by students in their post secondary and senior secondary classrooms;

7. determine the students' perceptions regarding the rate at which the content of the course is covered both at the post secondary and senior secondary levels; and,

8. compare associations between the nature of the classroom environment and the attitudes of the students towards their science studies at the college and senior secondary levels.

1.5 Overview of Thesis

This introductory chapter provides the purposes, background and the objectives of this study. Chapter 2 contains a review of literature relating to classroom environment research and the instruments employed in such research. The chapter covers an overview of the instruments developed over the years, learning environment relationships in university and the final year of high schools and also reviews relevant aspects of gender differences in the classroom.

Chapter 3 covers the development of the questionnaire as well as the methodology used in this study. This chapter also takes a detailed look at the features that make the modified version of the CUCEI different from the original CUCEI developed by Fraser, Treagust and Dennis (1986). The chapter also provides a review of the validation results of the original CUCEI. Additionally, the justification for the choice of scales in the assessment of student attitudes is also covered in Chapter Three.

The validity and reliability of the modified form of the CUCEI, for both actual and preferred versions of the student and teacher questionnaires, are discussed in Chapter 4. The reliability and validity of the scales of the assessment of students' attitudes as measured by the three scales, Difficulty, Satisfaction and Speed of course content are also discussed here.

Chapter 5 discusses the application of the modified CUCEI. Student and instructor perceptions, at the senior secondary and post secondary levels are discussed in this chapter. The chapter covers both quantitative and qualitative data.

Associations between the nature of the classroom environment and the attitudes of the students towards their science studies at the college and senior secondary levels are discussed in Chapter 6. This chapter also incorporates both quantitative and qualitative data.

The conclusions, implications, and limitations of this study, and suggestions for future study are covered in the final chapter, Chapter 7.

Chapter 2

LITERATURE REVIEW

2.1 Introduction

This chapter provides a review of literature which is relevant to the present study. The chapter falls into six distinct parts. First, there is an overview of some key instruments that have been developed as a result of research over the last 40 years. Additionally, this section includes sections related to the evolution of questionnaires, the questionnaires specifically designed for use in higher education settings, the type of questionnaire that has been adapted for this study, the need for both actual and preferred versions of instruments, and the need for teacher and student versions of the instruments.

This chapter also contains an overview of research carried out at the tertiary level, section 2.3, and studies which show the effects of transition from one level of education to another are discussed in section 2.4. Section 2.5 is devoted to associations between student outcomes and the classroom environment, and section 2.6 details the findings of gender-related studies and the attitudes toward science

that are considered important in the study of classroom environments. Finally, section 2.7 summarises the important findings in this literature review.

2.2 Research on Classroom Environments

2.2.1 Introduction

Despite the fact that the educational environment is a somewhat subtle concept, remarkable progress has been made in conceptualising, assessing and researching its determinants and effects. The research over the last four decades has recognised that students' and teachers' perceptions are important parameters of the social and psychological aspects of the learning environments of school classrooms (Fraser, 1986, 1991, 1994, 1998; Fraser & Fisher, 1994; MacAuley, 1990). Fraser (1994) supports the importance of this form of research as follows:

> Classroom or school environments in terms of the shared perceptions of the students and teachers in that environment, has the dual advantage of characterising the setting through the eyes of the actual participants and capturing data that the observer could miss or consider unimportant. Students have a good vantage point to make judgements about classrooms because they have encountered many different learning environments and have enough time in a class to form accurate impressions. (p. 494)

The foundation of the study of classroom environments was laid independently by Rudolf Moos and Herbert Walberg. Many studies have built upon the works of these two researchers resulting in many useful instruments being developed to measure the perceptions of students and teachers in a variety of environment settings (Fisher & Cresswell, 1997; Fisher & Fraser, 1982, 1990; Fisher & Waldrip, 1997; Fraser, 1986a, b, 1991, 1994, 1998 a, b; Fraser & Fisher, 1994; Fraser & Fisher, 1982a; Fraser, Anderson, & Walberg, 1982; ; Fraser, Fisher, & McRobbie, 1996; Fraser, Giddings, & McRobbie, 1992; Fraser, Treagust, Williamson, & Tobin, 1987; Jegede, Fraser, & Fisher, 1995; Kent & Fisher, 1997; Maor & Fraser, 1993; Rentoul & Fraser, 1979; Taylor, Fraser, & Fisher, 1997; Terwel, Berklemans, Wubbels, &

Eden, 1994; Wong & Fraser, 1994). The following sections are devoted to an overview of the theoretical under-pinnings of learning environments and the numerous instruments that have been developed and thus recognised as important contributions to measuring the perceptions of students and teachers of their classroom learning environment.

2.2.2 *Historical Overview of Some Key Instruments*

Moos (1979a) asserted that the classroom climate or environment is one of the most important influences in a student's personal and academic development. For example, Moos (1976) found in his research that students were satisfied in classrooms that had high student involvement, good student-teacher relationships, innovative teaching methods and clear rules governing behaviour. Supporting Moos' (1979a) findings, Walberg (1979) reported that students in competitive environments were found to perform poorly, be less self-assured and to experience more failure.

Important findings emerging from the work performed on social environments are three major categories of dimensions that characterise a variety of social milieus (Moos 1973, 1974). Most classroom environment instruments were designed taking into account Moos' scheme for classifying human environments. The three basic types of dimensions defined by Moos are:

i) *Relationship Dimension* which identifies the nature and intensity of personal relationships within the environment and assesses the degree to which people are involved in the respective environment and support as well as help each other.

ii) *Personal Development Dimension* which assesses personal growth and self enhancement.

iii) *System Maintenance and System Change Dimension* which assesses the extent to which the environment is orderly, clear in expectation, maintains control and is responsive to change.

These dimensions resulted from research in numerous social climate settings which included psychiatric hospitals (Moos & Houts, 1968), correctional institutions (Moos, 1968; Wenk & Moos, 1972), schools, and university student residences (Gerst & Moos, 1972; Trickett & Moos, 1973). Moos had shown these dimensions to be similar across various environments, although unique variations within general categories occurred in specific settings. Table 2.1 illustrates these similarities in differing environments.

The pioneering work of Moos and Walberg on perceptions of classroom environments laid the foundation for intensive research resulting in numerous publications over the last four decades (Fraser, 1991, 1994, 1998a, b; Fraser & Fisher, 1994; Wubbels, 1993a). Fraser (1991) outlined three common approaches usually employed in research on classroom environment. These were direct observations of events taking place in the classroom by an independent observer, utilising ethnography techniques; and assessing the perceptions of students and teachers using questionnaires. The relative ease of use and the low cost along with the potential for a large sample base has led to the widespread use of questionnaires in learning environment research. Fraser and Walberg (1981) outlined some further advantages on why the measurement of student perceptions is superior to observations in assessing classroom environments:

Table 2.1

Similarities of Social Climate Dimensions Across Various Environments

Type of Environment	Moos' Scheme of Classification		
	Relationship Dimensions	Personal Development Dimension	System Maintenance & System Change Dimension
Correctional Institutions	Involvement, Support, Expressiveness	Autonomy, Practical Orientation, Personal Problem	Order & Organisation, Clarity, Control
University Student Living Groups	Involvement, Emotional Support	Independence, Traditional Social Orientation, Competition, Academic Achievement, Intellectuality	Order & Organisation, Student Influence, Innovation
Junior High & High School Classrooms	Involvement, Affiliation, Teacher Support	Task Orientation, Competition	Order & Organisation, Teacher Control Innovation
Work Milieus	Involvement, Peer Cohesion,	Task Orientation, Staff Support	Work Pressure, Control, Innovation Physical Comfort
Hospitals	Involvement Support Spontaneity	Autonomy Practical Orientation, Personal Problem Orientation, Anger & Aggression	Order & Organisation, Clarity, Control

Adapted from Moos (1973)

i) perceptual measures are based on student experiences over time whereas observational data are usually restricted to relatively short time spans.

ii) perceptual measures are based on the combined judgement or feedback from students whereas observational data are obtained primarily by a single observer.

iii) in most cases student perceptions are more important determinants of student behaviour when compared to that of observed behaviours.

iv) perceptual measures have been found to account for more variance in student learning outcomes than have interaction variables obtained through observations..

Using these questionnaires, considerable work has been done on the assessment and investigation of classroom environments in primary and secondary schools (Fraser 1991, 1994, 1998; Fraser & Fisher, 1994). The instruments that are frequently used in the primary and/or secondary levels and that have gained international acceptance are the *Learning Environment Inventory* (LEI) (Fraser, Anderson, & Walberg, 1982; Walberg & Anderson, 1968b), the *Classroom Environmental Scale* (CES) (Fisher & Fraser, 1982; Moos & Trickett, 1987), the *Individualised Classroom Environment Questionnaire* (ICEQ) (Rentoul & Fraser, 1979), the *My Class Inventory* (MCI) (Fisher & Fraser, 1981; Fraser, Anderson & Walberg, 1982) and the *Science Laboratory Environment Inventory* (SLEI) (Fraser, Giddings, & McRobbie, 1991). These instruments have been extensively field tested and validated, and all have been developed to be user friendly and can be conveniently administered and scored either by hand or computer. A summary of these instruments is given in Table 2.2 below, followed by a discussion of each one.

Table 2.2

Overview of Classroom Environment Instruments; LEI, CES, ICEQ, MCI, & SLEI

Instrument	Level	Items per Scale	Scales classified according to Moos' Scheme		
			Relationship Dimensions	Personal Development Dimensions	System Maintenance and Change Dimension
Learning Environment Inventory (LEI)	Secondary	7	Cohesiveness Friction Favouritism Cliqueness Satisfaction Apathy	Speed Difficulty Competitiveness	Diversity Formality Democracy Material Environment Goal Direction Disorganisation
Classroom Environment Scale (CES)	Secondary	10	Involvement Affiliation Teacher Support	Task Orientation Competition	Order and Organisation Rule Clarity Teacher Control
Individualised Classroom Environment Questionnaire (ICEQ)	Secondary	10	Personalisation Participation	Independence Investigation	Differentiation
My Class Inventory (MCI)	Elementary	6-9	Cohesiveness Friction Satisfaction	Difficulty Competitiveness	
Science Laboratory Environment Inventory (SLEI)	Upper Senior Secondary Higher Education	6-7	Student Cohesiveness	Open-Endedness Integration	Rule Clarity Material Environment

The table summarises the level for which each instrument is suited, the number of items contained in each scale and the classification of each scale according to Moos' (1974) scheme of classifying human environments.

2.2.2.1 *Learning Environment Inventory (LEI)*

The LEI was in its infancy in 1960 and was developed in conjunction with research on the Harvard Project Physics (Fraser, Anderson, & Walberg, 1982; Walberg & Anderson, 1968a, b). Walberg began his independent work on learning environments at about the same as Rudolph Moos was actively studying in this same area of research (Fraser, 1994). Of particular importance during this period was Walberg's attempt to draw a relationship between teacher personality and student ability and interest in the subject based on Getzels and Thelen's (1960) theory of the classroom as a social system (Walberg, 1968a; Walberg & Anderson, 1968a). This relationship is diagrammed in the flow chart in Figure 2.1.

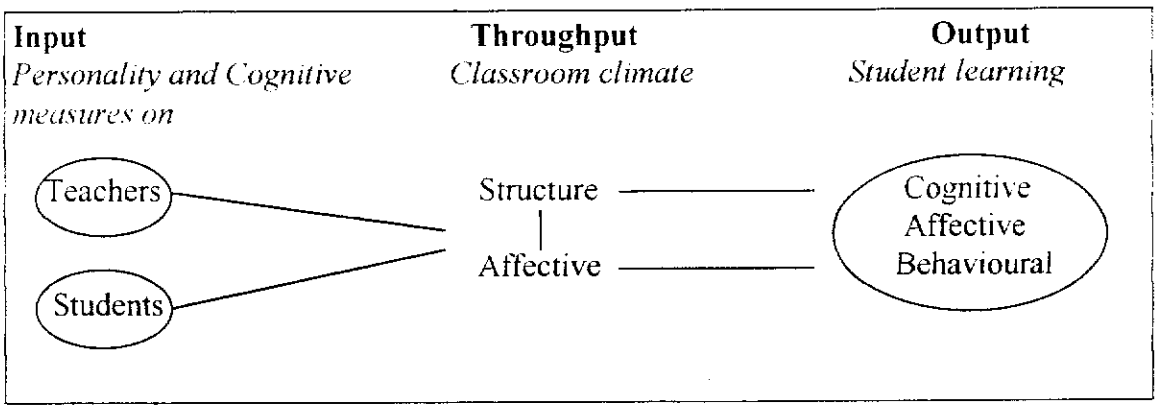

Figure 2.1. Schematic of Walberg and Anderson's (1968a) scheme to investigate classroom climate and individual learning (based on Getzels and Thelen's (1960) conceptual scheme of the classroom group as a unique social system).

The theory envisaged that social behaviour is the result of the individual's attempt to cope with an environment composed of patterns of expectations for the individual's behaviour in a way consistent with the individual's own independent pattern of needs. Putting it in the form of a general mathematical equation, $B = f(RP)$, where B is the observed behaviour, R is a given institutional role defined by the expectations attached to it, and P is the personality of the particular role incumbent defined by his/her need-disposition (Getzels & Thelen, 1960).

Walberg (1968b) devised an instrument along the general format outlined by Hemphill and Westie (1950). This instrument, the *Classroom Climate Questionnaire*, contained 18 scales in total. As a result of earlier studies with this questionnaire, the LEI evolved as an expansion and improvement of the Classroom Climate Questionnaire to the present design with 15 scales covering the three dimensions defined by Moos (1974). The final version of the LEI contains a total of 105 items, with each scale having seven items. Each item contains the response alternatives of Strongly Agree, Agree, Disagree and Strongly Disagree. The scoring direction or polarity of some of the questions is reversed. The instrument was designed for use at the secondary school level and has been validated and the results replicated in numerous countries, including the USA, Australia, Canada, Israel and India (Fraser & Fisher, 1983a). All scales of the LEI showed satisfactory internal consistencies and discriminant validity. The LEI has reported alpha coefficient values ranging from 0.54 to 0.85 (Fraser, 1991), and a discriminant validity (using the mean correlation of a scale with the other scales as a convenient index) ranging from 0.08 to 0.40 (Fraser, 1998). The discriminant validity suggests that the LEI measures distinct although somewhat overlapping aspects of the classroom environment.

2.2.2.2 *Classroom Environment Scale (CES)*

This instrument was developed by Moos as part of a comprehensive research program which measured the perceptions of a variety of human environments, including

university residences, prisons and psychiatric hospitals (Moos & Trickett, 1974). The final version of the instrument contained nine scales each having ten items of True-False response format. It has been validated in numerous studies (Fisher & Fraser, 1982; Fisher & Grady, 1986). Although the CES was used successfully for a variety of purposes, some researchers and teachers expressed preference for a faster and more economical instrument to administer and score. As a result of this expressed interest, a shorter version of the CES was developed by Fraser and Fisher (1983b).

Three criteria guided the development of this shorter version. First, the total number of items in the instrument was brought down to a manageable number so that it would take considerably less time to administer as well as to score. Second, the short form was designed to enhance easier scoring and finally the short version was to provide adequate reliability. The shorter version of the CES has 24 items compared with the longer version of 90 items. The scales in the long and short versions of the CES showed satisfactory internal consistency with Cronbach alpha coefficient values ranging from 0.71 to 0.90 and from 0.59 to 0.78 respectively (Fraser & Fisher, 1983a, b). The CES also had adequate discriminant validity values ranging from 0.09 to 0.40. Another desirable characteristic of a questionnaire like the CES is the ability of the instrument to differentiate between the perceptions of students in different classrooms. This involved a one-way ANOVA with class membership as the main effect and using the individual as the unit of analysis. Each CES scale differentiated significantly ($p<0.001$) between classrooms. The eta^2 statistic, which provides an estimate of the amount of variance in the CES scores attributable to class membership, ranged from 18 to 43 percent for different scales (Fraser, 1998).

2.2.2.3 Individualised Classroom Environment Questionnaire (ICEQ)

The *Individualised Classroom Environment Questionnaire* (ICEQ) was developed by Rentoul and Fraser (1979) and has long and short versions. The development of this instrument was guided by factors that distinguished individualised classrooms from

conventional ones and includes the scales of Personalisation, Participation, Independence, Investigation and Differentiation. Because of this focus on individualisation these scales are different from those in conventional instruments. Each scale contains ten items and a five-point Likert response scale of Almost Never, Seldom, Sometimes, Often and Very Often is employed. The validation process of this instrument resulted in Cronbach alpha coefficient values of 0.68 to 0.76 (Fraser, 1991).

The short form of the ICEQ consists of 25 items divided equally among the five scales. The alpha reliability values for the short version ranged from 0.63 to 0.85 (Fraser & Fisher, 1983b). This short form also showed adequate discriminant validity and the capacity to differentiate between students in different classes. The discriminant validity ranged from 0.07 to 0.28 and the eta^2 statistic ranged from 20 per cent for the Investigation scale to 43 per cent for the Differentiation scale (Fraser, 1998).

2.2.2.4 *My Class Inventory (MCI)*

A simplified form of the LEI was developed primarily for elementary school children in the 8 to 12 years age range and named the *My Class Inventory* (MCI) (Fraser, Anderson, & Walberg, 1982). It was developed in order to minimise fatigue among younger children when completing the questionnaire. Item wording was simplified to help younger students to comprehend, students were required to answer on the questionnaire itself, and responses were kept to a simple Yes-No format.

The final version of the MCI contains five scales and has a total of 38 items. In the validation process of this instrument with a sample size of just over 2,300 students, the Cronbach alpha coefficient values were reported to range form 0.73 to 0.88 (Fraser & Fisher, 1983a). The MCI also has a shorter version with 25 items divided equally among the five scales. The shorter version has an internal consistency ranging in Cronbach alpha coefficient values from 0.65 to 0.78 (Fraser, 1991, 1998a, b; Fraser &

Fisher, 1983a, b). The MCI also had adequate discriminant validity and the ability to differentiate between classrooms.

2.2.2.5 *Science Laboratory Environment Inventory (SLEI)*

The *Science Laboratory Environment Inventory* (SLEI) was developed because of the importance laboratory work plays in science education and the instrument was specially designed to assess the environment of science laboratories at the senior secondary or higher education levels (Fraser, Giddings, & McRobbie, 1991, 1993b; Fraser & McRobbie, 1995; Giddings & Fraser, 1990). The SLEI has seven items in each of five scales. The SLEI employs a five-point Likert response scale of Almost Never, Seldom, Sometimes, Often and Very Often. Interestingly, this instrument was field tested in upper secondary schools in six countries simultaneously: USA, Canada, England, Israel, Australia and Nigeria. At the same time, the instrument was also administered to university students in the same six countries. This validation process with a sample size of over 3,500 students gave Cronbach alpha coefficient values in the range of 0.70 to 0.83 (Fraser, 1991). The SLEI also showed adequate discriminant validity and the capability to differentiate between different classrooms. The discriminant validity figures ranged from 0.07 to 0.37 and the eta^2 statistic ranged from 19 per cent for the Open-Endedness scale to 23 per cent for the Integration scale (Fraser, 1991; 1998a).

Another instrument designed along the lines of the SLEI to measure students' and teachers' perceptions in the laboratory was modified specifically for use in Chemistry classrooms. The instrument, the *Chemistry Laboratory Environment Inventory* (CLEI) developed by Wong and Fraser (1994) has the same five scales as the SLEI, and was validated with a sample of 1,592 chemistry students in 56 secondary classes in Singapore. The alpha reliability for these scales ranged from 0.41 to 0.72 (Wong & Fraser, 1994).

2.2.3 *Recent Development of Some Key Questionnaires*

Other instruments which have been developed in the last few years are the *Computer - Assisted Learning Environments* (CALE) (Teh & Fraser, 1995) and the *Constructivist Learning Environment Survey* (CLES) (Taylor, Dawson, & Fraser, 1995). A newer CLES has been developed containing 30 items in five scales; Personal Relevance, Uncertainty of Science, Critical Voice, Shared Control and Student Negotiation. (Taylor, Fraser, & Fisher, 1997). The CLES has a reported internal consistency ranging in values from 0.61 to 0.89 (Taylor, Fraser, & Fisher, 1997). A summary of the above instruments and other instruments discussed in this section can be found in Table 2.3 below.

Classroom environment research was extended by focusing specifically on the interpersonal relationships between teachers and their students as assessed by the *Questionnaire on Teacher Interaction* (QTI) (Fisher, Henderson, & Fraser, 1995; Levy, Creton & Wubbels 1993; Wubbels, 1993b; Wubbels & Brekelmans, 1997; Wubbels, Creton, & Hooymayers, 1992). Studies involving the QTI have been further extended to the assessment of the influence of principals in schools, using the *Principal Interaction Questionnaire*, (PIQ) (Fisher & Cresswell, 1997).

A new instrument specially designed to study Tasmanian senior secondary colleges and utilising the scales of the College and University Classroom Environment Inventory (CUCEI) and the LEI was developed by Kent and Fisher (1997). *The Secondary Colleges Classroom Environment Inventory* (SCCEI), constructed from selected scales of the two existing instruments, contains five scales each having seven items responded to with either Strongly Agree, Agree, Disagree and Strongly Disagree. The five scales in the SCCEI are Personalisation, Informality, Student Cohesion, Task Orientation and Individualisation.

Table 2.3
Summary of Other Instruments

Instrument	Level	Items per Scale	Scales classified according to Moos' Scheme: Relationship Dimension	Personal Development Dimension	System Maintenance and System Change Dimension
Constructivist Learning Environment Survey *(CLES)*	Secondary	7	Personal Relevance Uncertainty	Critical Voice Shared Control	Student Negotiation
What Is Happening In This Classroom *(WIHIC)*	Secondary	8	Student Cohesiveness Teacher Support Involvement	Investigation Cooperation Task Orientation	Equity
Cultural Learning Environment Questionnaire *(CLEQ)*	Secondary	7	Equity Collaboration Deference	Competition Modelling Congruence	Teacher Authority
Secondary College Classroom Environment, Student Inventory *(SCCEI)*	Secondary	5	Personalisation Student Cohesion	Task Orientation Individualisation	Formality

Table 2.3 *Continued*

Instrument	Level	Items per Scale	Scales classified according to Moos' Scheme: Relationship Dimension	Personal Development Dimensions	System Maintenance and System Change Dimension
Secondary College Classroom Environment, Student Inventory *(SCCEI)*	Secondary	5	Personalisation Student Cohesion	Task Orientation Individualisation	Formality
Geography Classroom Environment Inventory *(GCEI)*	Secondary	4	Gender Equity	Investigation	Innovation Resource Adequacy
Computer Classroom Environment Inventory *(CCEI)*	Secondary	5	Satisfaction	Investigation Open-Endedness	Organisation Material Environment
Chemistry Laboratory Environment Inventory *(CLEI)*	Secondary	5	Student Cohesiveness	Integration Open-Endedness	Material Environment Rule Clarity

Fisher and Waldrip (1997) developed an instrument to assess culturally sensitive issues in classroom learning environments. *The Cultural Learning Environment Questionnaire* (CLEQ) contains 40 items and assesses students' perceptions in the following areas: Equity, Collaboration, Risk Involvement, Competition, Teacher Authority, Modelling, Congruence and Communication. The Cronbach alpha reliability for these scales ranged from 0.69 to 0.86 (Waldrip & Fisher, 1998).

The questionnaire, *What Is Happening In This Class* (WIHIC) was developed after an examination of the features of existing instruments and included some additional scales which were incorporated to account for current educational concerns such as equity and constructivism (Fraser, Fisher, & McRobbie, 1996). The WIHIC exists in a class form as well as in a personal form. This difference between class and personal forms is further discussed in section 2.2.10 of this chapter. The WIHIC in its original form had 90 items in nine scales, and this was modified to 80 items in eight scales. The WIHIC has been successfully used in studies involving adult and high school students in Singapore (Chionh & Fraser, 1998; Khoo & Fraser, 1997), Canada (Zandvliet & Fraser, 1998), Australia (Aldridge, Huang, & Fraser, 1998; Fraser, Fisher, & McRobbie, 1996) and Taiwan (Aldridge, Huang, & Fraser, 1998; Huang & Fraser, 1997). The validation process of this instrument gave Cronbach alpha coefficient values in the range of 0.81 to 0.89 (Aldridge, Huang, & Fraser, 1998).

One other instrument developed specifically for a study in secondary level Mathematics, The *Perception of the Curriculum in Action Questionnaire* (PERCIA) is a curriculum orientated modification of existing measures of perceptions of learning environments. PERCIA is a student questionnaire having five scales in which there is a total of 64 items. The five scales, Teacher Whole-class Instruction and Climate, Differentiation, Cooperation, Task Orientation, and Mathematics in real-life situations have a reported alpha reliability ranging from 0.77 to 0.88 (Terwel, Brekelmans, Wubbels, & Eden, 1994).

Table 2.4

Internal Consistency (Cronbach Alpha Reliabilities), Discriminant Validity, ANOVA Results for Class Memberships Differences for QTI, WIHIC, CLES, SLEI, GCEI, CCEI, CLEQ, SCCEI, CLEI & CLEI.

Scale	Alpha Rel.	Mean Correl.	ANOVA Results eta²
Questionnaire on Teacher Interaction (QTI)			
	(N = 3994 students)		
Leadership	0.82	- a	0.33*
Helping/Friendly	0.88	-	0.35*
Understanding	0.85	-	0.32*
Student Responsibility/ Freedom	0.66	-	0.26*
Uncertain	0.72	-	0.22*
Dissatisfied	0.80	-	0.23*
Admonishing	0.76	-	0.31*
Strict	0.63	-	0.23*
Constructivist Learning Environment Survey (CLES)			
	(N = 1081 students)		
Personal Relevance	0.88	0.43	0.16*
Uncertainty	0.76	0.44	0.14*
Critical View	0.85	0.31	0.14*
Shared Control	0.91	0.41	0.17*
Student Negotiation	0.89	0.40	0.14*
Geography Classroom Environment Inventory (GCEI)			
	(N= 348 students)		
Gender Equity	0.67	- b	0.38*
Investigation	0.65	-	0.64*
Innovation	0.52	-	0.60*
Resource Adequacy	0.68	-	0.53*

Scale	Alpha Rel.	Mean Correl.	ANOVA Results eta²
What Is Happening In This Classroom (WIHIC)			
	(N = 1081 students)		
Student Cohesiveness	0.81	0.37	0.09*
Teacher Support	0.88	0.43	0.15*
Involvement	0.84	0.45	0.10*
Investigation	0.88	0.41	0.15*
Task Orientation	0.88	0.42	0.15*
Cooperation	0.89	0.45	0.12*
Equity	0.93	0.46	0.13*
Science Laboratory Environment Inventory (SLEI)			
	(N = 3,727 students)		
Student Cohesiveness	0.77	0.34	0.21*
Open-Endendness	0.70	0.07	0.19*
Integration	0.83	0.37	0.23*
Rule Clarity	0.75	0.33	0.21*
Material Environment	0.75	0.37	0.21*
Computer Classroom Environment Inventory (CCEI)			
	(N= 120 students)		
Investigation	0.77	0.37	- b
Open-Endedness	0.62	0.34	-
Organisation	0.69	0.47	-
Material Environment	0.74	0.39	-
Satisfaction	0.91	0.45	-

a This statistic is not relevant for the QTI

b This statistic is not available.

*$p < 0.01$

Table 2.4
Continued

Scale	Alpha Rel.	Mean Correl.	ANOVA Results eta²	Scale	Alpha Rel.	Mean Correl.	ANOVA Results eta²
Cultural Learning Environment Questionnaire (CLEQ)				**Secondary Colleges Classroom Environment Inventory (SCCEI)**			
	(N 3,785 students)				*(N 1883 students)*		
Equity	0.74	0.09	0.12*	Personalisation	0.80	0.33	0.26*
Collaboration	0.74	0.12	0.08*	Informality	0.68	0.11	0.24*
Deference	0.69	0.18	0.13*	Student Cohesiveness	0.85	0.25	0.27*
Competition	0.86	0.17	0.09*	Task Orientation	0.73	0.28	0.28*
Teacher Authority	0.78	0.08	0.09*	Individualism	0.73	0.25	0.33*
Modelling	0.72	0.17	0.13*				
Congruence	0.83	0.16	0.10*				
Chemistry Laboratory Environment Inventory (CLEI)				**Computer Laboratory Environment Inventory (CLEI)**			
	(N= 1592 students)				*(N= 80 students)*		
Student Cohesiveness	0.68	0.23	0.10*	Student Cohesiveness	0.75	0.06	- b
Open-Endeness	0.41	0.03	0.08*	Open-Endedness	0.54	0.14	-
Integration	0.69	0.30	0.18*	Integration	0.94	0.09	-
Rule Clarity	0.63	0.28	0.19*	Technology Adequacy	0.73	0.22	-
Material Environment	0.72	0.25	0.18*	Material Environment	0.70	0.18	-

a This statistic is not relevant for the QTI
b This statistic is not available.
$^{*}p < 0.01$

A variety of other classroom environment instruments have also been developed for specific courses, such as the *Geography Classroom Environment Inventory* (GCEI) (Teh & Fraser, 1993) and the *Computer Classroom Environment Inventory* (CCEI) (Maor & Fraser, 1993). The internal consistencies, discriminant validity and ANOVA results for some of the instruments discussed here can be found in Table 2.4.

2.2.4 *Questionnaires for Higher Education*

Fraser, Treagust, Williamson, and Tobin (1987) reported that, despite the existence of strong traditional classroom environment research at the primary and secondary level,

surprisingly little work had been done at the higher education levels (e.g., Halpin & Croft, 1963; Pace, 1969; Pace & Stern, 1958; Stern, 1970). While acknowledging that some notable work has been done focusing on the institutional or school-level environment of universities and colleges (e.g., Halpin & Croft, 1963; Pace, 1969), Fraser and his fellow researchers concluded that this shortage of research at the tertiary level was because of the shortage of a suitable instrument. Examples of early work include the *College Characteristics Index* (CCI) (Pace & Stern, 1958) and the *College and University Environment Scale* (CUES) (Pace, 1969). The CCI had in its design 300 statements organised into 30 ten-item scales (Pace & Stern, 1958) whereas the CUES had five scales defined along Moos' dimensions; these scales were Community, Awareness, Scholarship, Practicality and Propriety (Pace 1969).

Early research which focused more on school-level environments formed the basis for a series of developments of a variety of instruments at the classroom-level in higher education settings, resulting in the *College and Universities Classroom Environment Inventory* (CUCEI) (Fraser, Treagust, & Dennis, 1986). Table 2.5 summarises these instruments that have been developed and used in various studies at the higher education levels.

2.2.4.1 *The College Classroom Environment Scales (CCES)*

The *College Classroom Environment Scales* (CCES) was specially designed for higher education institutions and validated in institutions in the USA (Vahala & Winston, 1994; Winston, Vahala, Nichols, Wintrow, & Rome, 1994). The instrument contained six scales with a total of 62 items. The scales in this instrument were Cathectic-Learning Climate, Professional Concern, Inimical Ambience, Academic Rigour, and Affiliation and Structure.

Table 2.5
Overview of Higher Education Instruments

Instrument	Items per Scale	Scales
College Classroom Environment Scales (CCES)	6	Cathectic-Learning Climate, Professional Concern, Inimical Ambience, Academic Rigour, Affiliation and Structure.
Distance and Open Learning Environment Scales (DOLES)	7	Interactivity, Institutional Support, Teacher Support, Negotiations, Flexibility, Task Orientation, Technological Support, and Ergonomics
Student Assessment of Teaching & Learning (SATL)	4	Preparation and Classroom Management, Interpersonal Skills Enhancement of Learning, Student Evaluation Practices.
Science Laboratory Environment Inventory (SLEI)	6 or 7	Student Cohesiveness, Open-Endedness, Rule Clarity, Integration, Material Environment
Computer Laboratory Environment Inventory (CLEI)	5	Student Cohesiveness, Open-Endedness, Integration, Education Technology Adequacy, Material Environment
College & University Classroom Environment Inventory (CUCEI)	7	Personalisation, Involvement, Student Cohesiveness, Satisfaction, Task Orientation, Innovation, Individualisation

2.2.4.2 *The Distance and Open Learning Environment Scale (DOLES)*

This instrument was developed for assessing students' perceptions when taking courses by distance education. The *Distance and Open Learning Environment Scale* (DOLES) developed by Jegede, Fraser, and Fisher (1995) for use among university students in distance education courses consisted of eight scales: Interactivity, Institutional Support, Teacher Support, Negotiation, Flexibility, Task Orientation, Technological Support, and Ergonomics. The final version of the validated DOLES questionnaire is currently being trialed with distance education students in Australia at the University of Southern Queensland and at Curtin University of Technology.

2.2.4.3 *Student Assessment of Teaching and Learning (SATL)*

The *Student Assessment of Teaching and Learning* (SATL) was designed to assess key elements of the interactive nature of classroom teaching and learning environments in higher education settings (Evans, Ellett, Culross, & Loup, 1994). The instrument has 55 items, with 11 items in the Preparation and Classroom Management, 10 items in the Interpersonal skills domain while the Enhancement of Learning domain had 24 items and the student Evaluation Practices had 10 items. The instrument was validated using a sample size of 448 students distributed across 28 different classes at Louisiana State University (LSU). The academic levels investigated ranged from freshman year through to doctoral courses. Cronbach alpha reliability coefficients for each SATL assessment domain ranged from 0.83 to 0.96 (Evans, Ellett, Culross, & Loup, 1994). This instrument was found to be an effective measure of students' perceptions of characteristics of teaching and learning environments in higher education settings, particularly with respect to non-traditional adult learners, typically part-time and older students. Evans, Ellett, Culross, and Loup (1994) also reported that the SATL has a distinct advantage over other instruments used to evaluate higher education classrooms in that there is little or no relationship to students' beliefs about the expected grades in the course they are taking.

2.2.4.4 Computer Laboratory Environment Inventory (CLEI)

The *Computer Laboratory Environment Inventory* (CLEI) an instrument for assessing computer laboratory environment was based on the Science Laboratory Environment Inventory (SLEI) (Newby & Fisher, 1997). The instrument had 35 items in five scales, namely, Student Cohesiveness, Open-Endedness, Integration, Rule Clarity, and Material Environment. The CLEI was validated with a sample size of 80 students taking a higher educational computing course at both undergraduate and postgraduate levels. The Cronbach alpha reliability for the seven-item scales ranged from 0.54 to 0.94, indicating a satisfactory internal consistency. The discriminat validity (using the mean correlation of a scale with the other scales as a convenient index) ranged from 0.06 to 0.22 suggesting that the CLEI measures distinct although somewhat overlapping aspects of the classroom environment. The dimension of Technology Adequacy, which measures the extent to which the hardware and software is adequate for the various tasks required for the laboratory lessons, is a unique feature of this instrument.

2.2.4.5 College and University Classroom Environment Inventory (CUCEI)

The *College and University Classroom Environment Inventory* (CUCEI) was developed in 1986 based on four criteria. First, the instrument was developed parallel to the classroom environment instruments that were used at the secondary and primary school levels. The CUCEI was specifically designed for upper secondary and tertiary levels utilising either seminar or tutorials as the mode of delivery, for small class sizes of about 30 students (Fraser, Treagust, & Dennis, 1986; Fraser, Treagust, Williamson, & Tobin, 1987; Williamson, Tobin, & Fraser, 1986).

Second, its scales provide coverage of the three general categories of dimensions identified by Moos (1974), Relationship, Personal Development and System Maintenance and System Change. Of the seven scales in the instrument, four are associated with the

Relationship dimension, one dimension with the Personal Development dimension, and two with the System Maintenance and System Change dimension.

Third, it had to be salient to higher education teachers and students. Finally the instrument had to be economical for teachers and students to use, thus the CUCEI was designed to have a relatively small number of scales, each containing a fairly small number of items.

Four versions of the instrument were designed, one for the students and another for the instructors, each having the actual and preferred forms (preferred forms are discussed in section 2.2.5). The final form of the CUCEI contains seven scales each having seven items. The items in the instrument are set up in a cyclic order so that each block of items measures the seven scales, as depicted in Table 2.6, with each item using the response alternatives of Strongly Agree, Agree, Disagree and Strongly Disagree.

The instrument was validated in an Australian study (Fraser, Treagust, & Dennis, 1986) resulting in Cronbach alpha coefficient values ranging from 0.72 to 0.92. The instrument was also cross-validated using American and Australian student samples (Fraser, Treagust, & Dennis, 1986). The findings in the study utilising the CUCEI were replicated in other studies in the USA, in Spanish Universities, and recently again in Australia (Fisher & Parkinson, 1998; Marcelo, 1988; Winston, Vahala, Nichols, Wintrow, & Rome, 1994; Yarrow, Millwater, & Fraser, 1997). The sensitivity, effectiveness and suitability of the CUCEI for higher education settings is clearly demonstrated in the above studies, details of which can be found in section 2.3 of this thesis.

Table 2.6

Descriptive Information for the Scales in the CUCEI

Scale Name	Moos Category	Scale description	Sample item & polarity
Personalization	R	Emphasis on opportunities for individual students to interact with the instructor and on concern for students personal welfare.	The instructor goes out of his/her way to help students (+).
Involvement	R	Extent to which students participate actively and attentively in class discussions and activities	The instructor dominates class discussions (-).
Student Cohesiveness	R	Extent to which students know, help and are friendly towards each other.	Students in this class get to know each other well (+).
Satisfaction	R	Extent of enjoyment of classes.	Classes are boring (-).
Task Orientation	P	Extent to which class activities are clear and well organised. (+).	Students know exactly what has to be done in our class
Innovation	S	Extent to which the the instructor plans new, unusual class activities, teaching techniques and assignments.	New and different ways of teaching are seldom used in this class (-).
Individualisation	S	Extent to which students are allowed to make decisions and are treated differently according to ability, interests and rate of working.	Students are allowed to choose activities and how they will work (+).

Items designated (+) are scored 5,4,2,& 1 respectively for the responses Strongly Agree, Agree, Disagree & Strongly Disagree. Items designated (-) are scored in the reverse manner. Omitted or invalid responses are scored 3. The categories: R: Relationship dimension, P: Personal Development dimension, S: System Maintenance and System Change dimension

Apart from having a satisfactory reliability, as measured by the Cronbach alpha coefficients, the discriminant validity for each of the forms of the CUCEI using both the individual and the class as the unit of analysis suggests that each CUCEI scale has adequate discriminant validity for its use in both actual and preferred forms. The discriminant validity figures ranged from 0.34 for the Individualisation scale to 0.47 for the Involvement scale (Fraser 1991, 1998a; Fraser, Treagust, Williamson, & Tobin, 1987). Furthermore, the instrument was found to be able to differentiate between the perceptions of students in different classrooms. The eta^2 statistic for the CUCEI using a sample size of 372 students in 34 classes ranged from 32 per cent for the Satisfaction scale to 46 per cent for the Individualisation scale (Fraser, 1998a; Fraser, Treagust, Williamson, & Tobin, 1987).

Because of the reliability, sensitivity and suitability of this instrument for the research described in this thesis, the CUCEI was adapted and modified for the present study. The adaptation and modifications are covered in detail in Chapter 3.

2.2.5 *Preferred and Actual Forms*

A feature of most classroom learning environment questionnaires is the availability of actual and preferred versions. The actual version measures the participants' actual perception of their classroom learning environment whereas the preferred or ideal form measures perceptions of the classroom learning environment ideally liked or preferred by the students in the study. The questionnaires contain similar items except the wording is changed to accommodate the type of measurement that is being taken. For example, the item "The instructor goes out of his/her way to help students", appearing in the actual form is reworded in the preferred version to read as "The instructor *would* go out of his/her way to help students."

The existence of the preferred form has provided a possible approach to improving classroom learning environments. For example, in a study involving the use of the ICEQ, Fraser and Fisher (1983c, d), using a sample size of 116 classes in Tasmania, compared the student actual with the student preferred scores and showed that student achievement could be improved if the classroom was changed to more closely match the students' preferred environment. Research has consistently shown that students prefer a more positive classroom environment than that which is actually present (Fisher & Cresswell, 1997; Fraser, Treagust, Williamson, & Tobin 1987; Suarez, Pias, Membiela, & Dapia, 1998; Villar, 1994; Yarrow, Millwater, and Fraser, 1997; Yuen-Yee & Watkins, 1994).

Having both preferred and actual forms of an instrument permits the exploration of whether students achieve better when there is a higher congurence between the actual classroom environment and that preferred by students. Such a study is what is referred to as person-environment fit research (Hunt, 1975). In every research study carried out investigating the person-environment fit hypothesis, there was a positive relationship between student outcome and their preferred environment (Fisher & Parkinson, 1998; Fraser & Fisher, 1983c,d; Fraser & Rentoul, 1980; Rentoul & Fraser, 1980; Wong & Watkins, 1996). The practical implications of these findings suggest that productive learning outcomes will most likely result when students perceive their classroom environment more favourably.

2.2.6 *Student and Teacher Versions of Questionnaire*

Another area of interest in classroom environment research is the difference between students' and teachers' perceptions of their actual and preferred environments. Studies have revealed that teachers and students perceive their environments differently. Generally, teachers perceive their classrooms more positively than do their students and students prefer a more positive learning environment as well as more input into their classroom activities than actually occurs (Fisher & Fraser 1983a; Fraser 1984; Fraser,

Treagust, Williamson, & Tobin 1987; Yarrow & Millwater, 1995). These interesting results have been replicated in studies in the United States (Moos, 1979a), Israel (Hofstein & Lazarowitz, 1986; Raviv, Raviv, & Reisel, 1990), The Netherlands (Wubbels, Brekelmans, & Hooymayers, 1991), Singapore (Wong & Fraser, 1994), Spain (Suarez, Pias, Membiela, & Dapia, 1998; Villar, 1994) and Australia (Fraser, 1982; Fraser, 1985; Fraser & O' Brien, 1985; Yarrow, Millwater & Fraser, 1997).

Feedback information based on teacher and/or student perceptions has also been employed successfully to improve classroom and school environments at the various levels of education (De Young, 1977; Fisher & Fraser 1991; Fisher, Fraser, & Bassett, 1995; Fisher & Parkinson, 1998; Thorp, Burden, & Fraser, 1994; Yarrow & Millwater, 1996; Yarrow, Millwater, & Fraser, 1997; Woods & Fraser, 1995). Though teacher perceptions are useful, there is evidence in the literature showing that students' perceptions are a better indicators of teacher behaviour than the perceptions of teachers themselves (Marsh, 1984). Furthermore, students' perceptions of the learning environment are of special importance because they are strongly related to student outcomes (Fraser, 1986).

2.2.7 *The Personal Form of Classroom Environment Instruments*

In the development of the questionnaires included in Tables 2.3 and 2.5, the study of classroom environments involved the class as a whole. Recent studies now indicate that a personalised measurement, that is the student's personal perception of his or her role in the classroom yields greater feedback from participants in the study (Fraser, Fisher, & McRobbie, 1996; Fraser, Giddings, & McRobbie, 1992, 1993a; Fraser & McRobbie, 1995). The personal approach assesses a student's perception of his or her role in the classroom, whereas the former approach asks the student to provide perceptions of the class as a whole. The personal form has also been found to be more sensitive in gender-related investigations as well as in individualised case studies (Fraser & Tobin, 1991). The

first questionnaire that utilised the personal form was the Science Laboratory Environment Inventory (SLEI), (Fraser, Giddings, & McRobbie, 1993). The Table 2.7 below gives an indication on how items were reworded to form personalised versions of instruments.

Table 2.7
Difference in wording of items to form personalised instruments

Scale	Class form	Personal Form
Student Cohesiveness	Students are able to depend on each other for help during laboratory classes. (+)	I am able to depend on other students for help during laboratory classes. (+)
Material Environment	The laboratory is crowded when we are doing experiments. (-)	I find that the laboratory is crowded when I am doing experiments. (-)

* Items chosen from the Science Laboratory Environment Inventory

A more recent example was the personalisation of the short form of the ICEQ which formed the basis of the Science Classroom Environment Survey (SCES) (Fisher & Stolarchuk, 1997).

2.3 Tertiary Level Environments

2.3.1 *Introduction*

Although classroom environmental studies in the primary and secondary levels have been extensive, research into the classroom environment at the tertiary level has been limited (Fraser, Treagust & Denis, 1986; Genn, 1981). However, considerable research has been carried out on predicting students' academic success at the university level (e.g., Killen, 1994; Larose & Roy, 1991). Killen's (1994) work suggested that instructors' perceptions

of students' failure to succeed in university work was due to irregular attendance at lectures, poor literacy skills, too much reliance on direction from lecturers, lack of self discipline, insufficient effort, lack of academic ability, failure to realise that the depth of understanding required at university is different from that required at school, lack of maturity and the lowering of entrance requirements. Students however, perceived that their failure in university studies was caused by lecturers who are out of touch with students' needs, too many demands on students' time, boring presentations by lecturers, assignments for which expectations were not clear, inappropriate assessment procedures, heavy course workload and lecturers with unrealistically high expectations of students. Similar findings were also evident in a study by Booth (1997) when he investigated experiences and expectations of students in transition from high school to university studies.

2.3.2 *Classroom Learning Environments*

Though some notable work has been done in the past on institutional or school-level environments of universities and colleges (e.g., Halpin & Croft, 1963; Pace & Stern, 1958; Stern, 1970) classroom-level studies were virtually absent. Fraser, Treagust, and Dennis (1986) and Fraser, Treagust, Williamson, and Tobin (1987) did investigate higher education classroom environments, utilising the College and University Classroom Environment Inventory (CUCEI) and this instrument was also adapted and validated in higher education institutes in the USA and Spain (Marcelo, 1988; Winston, Vahala, Nichols, Wintrow, & Rome, 1994). Recently, the instrument has been utilised by Yarrow, Millwater and Fraser (1997) to assess student perceptions of their actual and preferred environments to identify actual-preferred discrepancies and so guide improvements in a second year university education program in Australia.

Fraser, Treagust, and Dennis (1986) utilised the CUCEI in evaluating alternative high schools which catered for adult learners. Fraser, Treagust, Williamson, and Tobin, (1987)

completed a similar study utilising a comparative approach with respect to adult learners in two alternative high schools with four control situations involving the following scenarios: technical colleges where adults can attend the evening classes out of interest; conventional grade 11 or 12 classes with adult learners enrolled and integrated in the conventional classes; conventional grade 11 or 12 classes with no adult learners; and senior colleges that cater for the adult learners.

The study showed that the most favourable environment was evident in the evening technical college, followed by the senior colleges, high school catering for adolescents only and finally, the high school where the adults were integrated with adolescents. The only exception to this trend was in the student cohesiveness scale which was perceived more favourably in the high school environment. This study also supported the work of Moos (1979) also where research was conducted at five types of high schools; urban, suburban, rural, vocational, and alternative. Moos (1979a) found that students' perceptions of the classroom were influenced by the type of school the students attended.

Fraser, Treagust, Williamson, and Tobin (1987) also revealed that the classroom perceptions of students and teachers yielded results which were similar to prior research completed in secondary and primary levels, both in the USA (Moos, 1979) and Australia (Fisher & Fraser 1983a, b; Fraser 1984). Both students and instructors preferred a more positive environment than what they perceived to be present in their classrooms. However, instructors tended to perceive their classes more favourably on several of the environment scales than did their students. Such a trend was also evident in a study by Villar (1994) which focused on tertiary student teachers in a college of education in Spain. Villar (1994) found that a cooperative teacher-centred model was what students preferred in all classes and that students also wanted to have a greater say in the evaluation process. In other studies, Cooper (1995a, b) and Vahala and Winston (1994) also found support for the cooperative model.

Yarrow, Millwater, and Fraser (1997) also found similar results to those of Fraser, Treagust, Williamson, and Tobin (1987) with regard to the preference of a more positive environment in the classroom. In this study, the primary aim was to improve the university classroom environment of preservice teachers in their second year of studies through the use of the actual and preferred versions of the CUCEI. Results from the actual and preferred forms were used by the instructor to promote greater congruence between their actual environment and what students perceived to be important in their ideal environment. Student feedback by the end of the semester revealed that students were happier with the changes the instructor introduced in the classrooms. This more favourable environment in the students' classrooms was reflected from the data obtained from the CUCEI. The results indicated that there were significant deficiencies in the university classroom learning environment of the preservice teachers early in the semester. At the end of the semester, the greatest positive changes were observed to be in areas of satisfaction, individualisation, personalisation and an increase in classroom cohesiveness.

In a similar study utilising the CUCEI, though for the first time in an undergraduate nursing program, Fisher and Parkinson (1998) showed that the classroom environment could be improved using feedback from student perceptions to change the environment toward that preferred by the students. One interesting revelation in this study was of the students' lack of satisfaction with the approaches related to the lecture overload that they were exposed to each day. This was overcome by employing alternative approaches to presenting material, for example by the use of such formats as class discussion groups and student acceptance of responsibility in preparing their work prior to scheduled sessions.

Bloom's (1976) research led to the view that most students become very similar with respect to their learning ability, rate of learning, and motivation for further learning when provided with a favourable learning environment. However, when the students are provided with unfavourable learning conditions, they tend to become dissimilar with

regard to learning ability, rate of learning, and motivation for further learning. Bloom viewed teaching as an incorporation of shortfalls for the students in the courses they were taking. He considered that redesigning or restructuring of learning tasks or some combination of the two could be used to overcome the initial lack of prerequisites in a course. Thus, the focus was to shift from the management of learners to that of the management of learning. De Young (1977) found in his studies of undergraduate education students that studies in the classroom climate facilitated specific changes in teaching strategies, thus enhancing the learning of students. De Young (1977) found, as well, that there were fewer absences in classrooms where the climate was closer to the students' preferred learning environment. Similar findings were reported by Hamilton and Wallace (1996) in a study involving students in Biology laboratories at regional universities in Australia.

Shavelson and Stern (1981), however, believed that teaching occurs in a very complex environment. Teachers therefore continuously need to perform comprehensive assessments of their classroom learning environments so that they can change and adapt to the ever-changing needs of their students. This can be established by feedback from their peers and students. The work of Fisher and Parkinson (1998), Oei and Chopra (1975) and Yarrow, Millwater, and Fraser (1997) adds support to this view by showing that student feedback to lecturers at the university level led to positive changes in the lecturers' performances and thus improved the overall classroom environment.

2.3.3 *Discipline and Type of Tertiary Institution*

Vahala and Winston (1994), in a recent study utilising the College Classroom Environment Scales (CCES) in 35 introductory first and second year college/university courses in English composition, social, laboratory and behavioural science supported some of the findings discussed above in section 2.3.2. However, the study not only looked into the classroom environment in these classes but also the influence of the type of

institution in which the students were situated, whether a university or a two-year college. This approach was in line with Moos' (1979) work showing that the type of school students attend has an influence on their perceptions of the classroom environment.

Vahala and Winston's (1994) research yielded some interesting findings similar to those of Moos (1979). Firstly, there were significant differences in the students' perceptions of their classroom climates depending on the type of institution they attended. Two-year college students perceived their classes to have greater academic demands and higher standards than those in universities. The researchers explained this in part by differences in the students' academic preparation and experience when compared with those pursuing similar courses at universities. Vahala and Winston (1994) suggested that there may be a larger gap between students' academic competencies and faculty expectations at two-year colleges than at the universities.

Secondly, the two-year colleges were perceived to have less structure when compared with universities. However, college students found their instructors were generally more concerned about their personal development and learning. English instructors were found to demonstrate greater concern about their students' personal development and learning than the laboratory-based science faculty members. Vahala and Winston (1994) suggested that the faculty members at universities formalised their requirements and were more rigid than the colleges and thus were perceived as less caring and more structured. Finally, laboratory science classes were perceived as having more hostile and intimidating environments in comparison with the other disciplines.

This study was consistent with the findings of Astin (1965) where it was reported that higher education classroom environments reflected systematic differences in the various fields of study. For instance, it was reported that English and fine arts classes were perceived to have a high order of humour, diverse opinions and class discussions whereas social science courses were characterised by little discussion, little homework and often

arguments with the instructors. Many of the findings in this study, such as the less caring attitude of instructors, cooperation among students and less structure resulting in more independent work, are also clearly present in studies looking at the transition problems (*Section 2.5*).

2.4 Transition Environments

2.4.1 *Introduction*

Moos (1976b) suggested that environments may influence behaviour and development in five ways: they may limit behaviour; enable the occurrence of activities; actively stimulate some forms of activity; selectively favour the preferred modes of adaptations and hence, the development of some individuals over others; and finally, they may be actively stressful, creating conditions which retard development. Studies involving transition from one level of education to another indicate some or all of these behavioural and developmental influences. The movement of students and the difficulties in re-adjustments from one level to another have been researched extensively but most studies on transition are limited to primary, junior high schools and senior secondary levels (e.g., Beavis, 1981; Blyth, Simmons, & Bush, 1978; Cotterell, 1992; Midgley & Feldlaufer, 1987; Midgley, Feldlaufer, & Eccles, 1988b, 1989a, b; Mittman & Packer, 1982; Power, 1981; Power & Cotterell, 1981; Reuman, 1984; Rice, 1997; Rollnick, Manyatsi, Lubben, & Bradley, 1998; Simmons, Burgeson, & Carlton-Ford, 1987). Nisbet and Entwistle (1969) for instance, reported that transfer to high school affects different children in different ways. Transfer problems appear to be a function of factors such as social background, gender, maturity, and self-sufficiency. Power (1981) reported that these same student characteristics are in fact associated with attitudes to their science courses. These findings support and reinforce the assertions made by Moos (1979) that the environment has a direct influence on the behaviour of students. When students move up to higher

levels of education, their perceptions of the classroom environment has been observed to change.

2.4.2 *Primary Secondary Transition*

Midgley (1991) and fellow researchers studied the student, teacher, and observer perceptions of the classroom environment before and after transition of students from the elementary to junior high school. The study primarily focused on the mathematics classroom environment. The study tested the following three hypotheses: after the transition to junior high school, students will have less autonomy and fewer opportunities for input and choice than before transition; there will be an increase in whole class task organisation, competition and social comparison among students, and a decrease in opportunities for cooperation and interaction among students; and teachers will be perceived as less caring, supportive and friendly than were teachers before transition.

All three hypotheses were supported, with the exception of increased competition. Similar findings in that there were no differences between primary and secondary classrooms in the level of perceived difficulty, competitiveness or academic pressure were reported by Power & Cotterell (1981). However, in another study, Midgley (1991) and fellow researchers revealed that students were more aware and concerned about how they performed relative to others in class at the higher level of study. Students were thus developing a keener understanding of the concept of ability via their performance in class. This same trend, a decline in classroom social climate during the transition to junior high school, was also reported in studies by Brendt and Hawkins (1985), and Schulenberg, Asp, and Petersen (1984).

In another study related to transition problems, Ferguson and Fraser (1996) found that in general when students moved from their elementary school to the high school they perceived their high school environment less favourably, particularly in terms of teacher

helpfulness, leadership and understanding. However, the study showed a favourable trend in terms of reduction in friction and competition, which was different from that observed by Midgley, Eccles, and Feldlaufer (1991). The overall pattern of the study by Ferguson and Fraser (1996) suggested a negative trend in the learning environment perceptions during the transition from elementary to high school. However, they did find an interesting pattern with respect to the classroom environment when related to school-size pathways. Students from small-sized elementary schools compared with medium-sized elementary schools experienced greater negative changes in their environment when they moved to high school. The study, however, reported that students who moved to high schools which were situated on the same campus or site as the elementary school experienced the greatest negative change in their environment. Ferguson and Fraser (1996) suggested a possible reason for this negative change might have to do with class identity and identification with the school they came from, which remained strong as there was relatively no change with the school environment. In contrast to the findings of Ferguson and Fraser (1996), Cotterell (1979) reported that students from small schools perceived the transition from primary to secondary schools more positively than did those from larger schools. Power and Cotterell (1981) on the other hand, found that teachers often operate with false notions about the lives of students coming from another level. As a result of these false notions, students could suffer in two ways: teachers at the lower level may prepare students for a future which does not exist and, secondly, teachers at higher levels may dismiss or disregard their previous learning experiences. Beavis (1981) supported this but goes on to report that teachers may also proceed in their classes after transition on the basis that students had skills and approaches to learning which were either never acquired or never exercised.

Jarman (1990) reported in his study of continuity of primary to secondary science that students found that they could hardly recognise the subjects in comparison to those that were taken at the elementary level. This was primarily related to the substantial changes in the teaching and learning of science they experienced in their move to the higher level of

studies. Power and Cotterell (1981) however, showed a general decline in student attitude towards science subjects occurred in the early part of the transition but that attitudes subsequently became more positive.

Other studies on transition of students from primary to secondary level showed similar trends in terms of students experiencing or expecting to experience a less favourable interpersonal relationship with their teachers after transition (Brendt & Hawkins, 1985; Cotterell, 1979; Hirsch & Rapkin, 1987; Power, 1981; Power & Cotterell, 1981; Trebilco, Atkinson, & Atkinson, 1977). Research has clearly indicated that the quality of student-teacher relationships is associated with students' academic motivation and attitudes towards school (Fraser & Fisher, 1982; Midgley, Eccles, & Feldlaufer, 1991; Moos, 1979; Trickett & Moos, 1974). For example, Fraser and Fisher (1982) found positive correlations between teacher support and junior high school students' enjoyment in their science classes. Similarly, the teacher support factor was evident in students' academic adjustment before and after the transition to junior high school (Hirsch & Rapkin, 1987; Midgley, Eccles, & Feldlaufer,1991; Trebilco, Atkinson, & Atkinson, 1977).

Teachers generally believe that each level of education has been defined by societal expectations (Power & Cotterell, 1981). At the primary level it is expected to be child-orientated and to focus on basic skills whereas high schools are more formal, subject-centered and competitive. Post-transition teachers in the high schools also reported that they trust their students less and believe more strongly in controlling and disciplining students than do the pre-transition teachers at the primary levels (Midgley, Eccles, & Feldlaufer, 1991; Midgley, Feldlaufer, & Eccles, 1988a). This study also reported that post-transition teachers had a weaker sense of teaching efficacy than did the pre-transition teachers. In another study, changes in student attitudes were related to their teachers' sense of efficacy before and after transition (Midgley, Feldlaufer, & Eccles, 1989a). Students who moved from more to less supportive teachers experienced a decline in their valuing of the subject matter, in this case mathematics, while the reverse was true when

students moving from less to more supportive teachers became more positive about the value of the mathematics course they were taking (Midgley, Eccles, & Feldlaufer,1991; Midgley, Feldlaufer, & Eccles, 1989a, b).

Teachers in the study conducted by Power and Cotterell (1981) indicated that one of their main concerns was the unrealistic expectations held by teachers at the next level of studies, in this case high school teachers. This was expressed by one teacher in the above study as follows:

> We always have the feedback from high school teachers: what have they taught them in the primary school? They come to us absolutely raw. They know nothing. What are they doing down there in, say, Maths? They can't divide, some can't even add up. Of course you'll always get some kids that can't divide. (p. 7)

In contrast, primary school teachers viewed high school teachers as being more concerned with teaching subjects rather than students. Apportioning blame by instructors at the different levels sees no boundaries as this trend is apparent at the higher education settings as well (Booth, 1997).

Most of these concerns are very similar to the perceptions reported by students as indicated in sections 2.3, 2.4 and 2.6 of this thesis. Clearly, teachers at each level have different expectations when students move into or transit to different levels of studies. This change in expectations and the changes in the environment are two of the major problems that students face during their period of transition.

2.4.3 *Secondary Tertiary Transition*

Transition studies from secondary to tertiary are relatively few in comparison to studies carried out at the primary and secondary levels (Booth 1997; Ramsden, 1991; Ramsden & Entwistle, 1981; Ramsden, Martin, & Bowden 1987; Ramsden, Patrick, & Martin, 1988;

Richter, 1997; Rollnick & Manyatsi, 1997). Ramsden (1991) investigated whether there were links to the learning environments in Grade 12 students going onto higher studies in the city of Melbourne, Australia. The results from Ramsden's work and work with his associates (Ramsden, Martin, & Bowden, 1987; Ramsden, Patrick, & Martin, 1988) seems to support the view that approaches to learning in Grade 12 and in higher education are strongly related. Such conclusions were also evident in a study involving British university students (Ramsden & Entwistle, 1981). Basically the students' approaches to learning are functionally related to the environment in which the students find themselves. This includes the classroom environment, the teacher, the school environment and the type of school the student was coming from. The three most important perceptions of good teaching, freedom of learning and workload were found to be important in both year 12 and higher studies. Supporting the findings of Ramsden (1991) is the study of Booth (1997) who researched the experiences and expectations of students at the point of entry to a history degree programme. He found that, apart from good teaching, the students would fare better if there were clear and concise communications and higher student involvement in class. Also the university professors needed to have good inter-personal relationships with their students. This is best summarised by student interviews in his research:

> Good - willing to listen to your ideas and opinions without laughing at them or making you feel stupid. Knows the subject thoroughly and can put it across well. Understanding and flexible. Bad - has his own opinions and everything else is wrong.
>
> Someone who is enthusiastic about the subject but who can explain and transfer the knowledge to students easily makes a good teacher. The teacher who just speaks at the students and presume they know and can understand everything fail to be interesting or helpful.
>
> (Booth, 1997, p. 212)

Other problems that were reported by Booth (1997) were a lack of general concern for students by the university lecturers and the students finding the environment to be much more task oriented leading to much heavier work loads. These results are similar to findings at the primary and secondary levels (e.g., Brendt & Hawkins, 1985; Cotterell, 1979; Hirsch & Rapkin, 1987; Power & Cotterell, 1981; Trebilco, Atkinson, & Atkinson, 1977). Similar findings were also reported by Ritcher (1997) in a study investigating student transition from secondary to higher education in Germany. These findings were well summarised by one student in Booth's (1997) study who comments:

> At A level (British final year high school) we tended to be very spoon-fed with dictated notes, and if we were told to do any background reading (which was rare) we were told exactly which pages to read out of which book. (p. 208).

Booth's (1997) study also found that students entering university studies in History had difficulty recognising the subject in comparison with that taken at the secondary level. Interestingly, such a finding with respect to science subjects was also evident in Jarman's (1990) study of continuity of primary to secondary science.

Rollnick and Manyatsi's (1997) work in South African institutions further supports the many findings of Ramsden (1991) and Booth (1997). Students entering tertiary studies in South Africa experienced the pace of lectures to be too fast, resulting in increased workloads. Similar findings were also reported in a study in Taiwan involving first year university physics students (Chang, 1999). The study by Rollnick and Manyatsi (1997) also found that students entering tertiary classes from very good secondary schools did not find the academic workloads that demanding as did students who came from schools in regions of South Africa which were disadvantaged.

The research reviewed generally points to a less favourable learning environment and the resultant difficulties experienced by students during the transition process. Research seems to indicate that the difficulties and adjustment problems that students face seem to

occur at all levels of transition and are not confined to a particular level. The study described in this thesis is distinct, as it is the first to utilise a personalised form of the CUCEI in higher education settings. The study looks at the classroom environment problems faced by students as they proceed from their final year at high school to their first year of studies at the university level at a local Community College in Northwestern British Columbia, Canada, and the influence of student attitudes at these two levels.

2.5 Classroom Environment Associations and Outcomes

Walberg's theory on educational productivity indicates that there are nine factors which contribute to the variance in students' cognitive and affective outcomes, these factors being student ability, maturity, motivation, the quality and quantity of instruction, the psychological environment at home, the classroom social group, the peer group outside the classroom and the time involved with the video/television media (Walberg, 1981, 1984, 1991). This model of educational productivity was successfully tested as part of a national study which showed that student achievement and attitudes were influenced jointly by a number of these factors (Walberg, Fraser, & Welch, 1986). An interesting outcome from these studies was the finding that classroom and school environments were important influences on student outcomes. These findings lend support to Getzels and Thelen's (1960) theoretical model which describes the class as a social system in which group behaviour can be predicted from personality needs, role expectations and classroom environment.

Much of this past research has involved the assessment of science classroom learning environments, from both teacher and student perspectives, and the investigation of associations between learning environment variables and student outcomes. For example, in a meta-analysis reported by Haertel, Walberg, and Haertel (1981) with a sample size of 17,805 students in 823 classes in four nations, student achievement in classes was found

to be enhanced with greater Cohesiveness, Satisfaction, Goal Direction, and less Disorganisation and Friction. Other research studies have consistently supported the existence of associations between classroom environment variables and student outcomes. Fraser, Walberg, Welch, and Hattie (1987) provided further evidence linking educational environments and student outcomes. Similar findings supporting this link were reported by Henderson, Fisher, and Fraser (1998) where 100 students in seven classes, representing one third of the total population of Environmental Science students in Tasmania, had more favourable attitudes in classes where students perceived greater cohesion amongst students, a greater degree of student involvement in classroom activities and a higher level of task orientation. Apart from this, other recent studies using the SLEI, and an instrument specially designed for computer assisted instruction, the CLEI, further supported the associations of students' cognitive and affective outcomes with perceptions of the classroom environment (Fraser & McRobbie, 1995; Newby & Fisher, 1997; Teh & Fraser, 1995; Wong & Fraser, 1996).

In another study, Anderson, Saltet, and Vervoorn (1980), reported that senior colleges having only year 11 and 12 classes were found to have a distinct culture from that in traditional high schools. In particular there were more favourable perceptions of teacher student relationships as well as student responsibility and freedom. This finding was supported by the research of Stoessinger and Wilson (1985) in which students reported that they found teachers generally approachable and there was not a superior-inferior relationship. Ramsden (1991) concluded that the Year 12 learning environments are accurate predictors of the quality of learning that students receive. In his study, Ramsden (1991), with a sample size of 374 students from both grade 12 and first year of university study, showed that the positive environment is carried over to the first year of higher education through the approaches to learning developed and experienced in Year 12. Regression analysis of the first year approaches on Grade 12 approaches to learning, school mean ethos, and three variables measuring perceptions of the higher education learning context; good teaching, freedom of learning, and workload, clearly showed that

students' approaches to learning were functionally related to the environment in which the students found themselves.

These findings are in line with those of Moos (1976, 1979b) who found in his research that students were satisfied in classrooms that had high student involvement, personal student-teacher relationships, innovative teaching methods and clear rules governing behaviour. Similar findings were also reported by Chang (1991) where the use of innovative teaching approaches, interactive teaching, in university physics classes increased students' interest, enjoyment, satisfaction and level of involvement. Researchers in general have argued against the effectiveness of didactic ways of teaching and have emphasised the crucial role of engaging the learners in the teaching process (Bell, 1993; Duit & Treagust, 1998; Linder & Erickson, 1989; McDermott, 1993)

Moos (1976, 1979b) also found that students tended to learn more in classrooms that are considered more difficult and competitive. However, in such environments there was a tendency for more absences from the classroom. He also concluded in his study that a structured class may be beneficial to some but in some instances the reverse is true. Walberg (1979) on the other hand reported findings similar to those of Moos (1979) where students in competitive environments were found to perform poorly, be less self-assured and experienced more failure. Similar findings showing that a positive environment is beneficial to learning has been reported by Fraser (1991), Freedman (1997), Germann (1988) and Templeton and Jensen (1993). The importance of student-teacher relationships have been reported in many studies utilising the QTI in Australia, The Netherlands, and Singapore (Fisher, Henderson, & Fraser, 1995; Fraser, 1998; Goh & Fraser, 1996; Goh, Young, & Fraser, 1995; Kent & Fisher, 1997; Rickards, Fisher, & Fraser, 1997; Wubbels & Brekelmans, 1997). Studies have also indicated that cooperative learning lends to greater student achievement than competitive learning (Banerjee, 1997; Cooper, 1995a, b; Johnson, & Johnson, 1991; Johnson, Maruyama, Johnson, Nelson, & Skon, 1981).

Moos (1979a) also found in his studies that students and teachers were in greater agreement on the characteristics of a preferred classroom, although, teachers placed a greater emphasis on task orientation and rule clarity than did their students. Moos, however, found considerable variations in the qualities perceived by students and teachers. This finding is replicated in numerous studies (Fraser, Giddings, & McRobbie, 1992, 1993; Fraser, Treagust, Williamson, & Tobin 1987; Fraser & Walberg, 1991; Hofstein & Lazarowitz, 1986; Lim, 1995; Raviv, Raviv, & Reisel, 1990; Suarez, Pias, Membiela, & Dupia, 1998; Wong & Fraser, 1994).

Research has also been carried out to gauge the effects of students' age on their perceptions of the classroom environment which revealed an interesting trend (Yager & Penick, 1986; Yager & Yager, 1985). As students became older, they became more uncomfortable with science and the subject matter became less interesting to them. However, though there was decline in the attitude towards science by older students, the attitudes toward their teacher were found be more positive (Hofstein & Welch, 1984).

Considerable work has been carried out with respect to associations of student outcomes with the classroom environment, though most of this research has been carried out at the primary and secondary levels. Table 2.8 gives an overview of some of the past studies which have looked into this feature of research and have supported the existence of associations between classroom environment variables and student outcomes.

Table 2.8

Overview of Some Studies of Associations Between Student Outcomes and Classroom Environment.

Study	Outcome Measures	Sample
Studies involving LEI		
Anderson & Walberg (1968); Walberg & Anderson (1968a); Anderson (1970);	Selected from: Achievement; understanding of nature of science; science processes; participation in Physics activities; science interest; attitudes	Various samples (maximum of 144 classes) of senior high school Physics students, mainly in USA but some in Canada.
Walberg (1969a, 1969b,1972)	Examination results	1600 grade 10 and 11 students in various subject areas in 64 classes in Montreal, Canada
Lawrenz (1976)	Science attitudes	238 senior high school science classes in midwest USA.
Fraser (1978b, 1979)	Inquiry skills; attitudes; understanding of nature of science	531 students in 20 grade 7 science classes Melbourne Australia.
Power & Tisher (1975, 1979)	Achievement; attitudes; satisfaction	315 junior high school students in 20 science classes in Melbourne, Australia.
Hofstein et.al. (1979)	Attitudes	400 grade 11 students in 12 Chemistry classes in Israel.
Haladyna, Olsen & Shaughnessy (1982); Haladyna, Shaughnessy, & Redsun (1982a, b); Haladyna, Shaughnessy, & Shaughnessy (1983).	Attitudes	5804 science, mathematics and social studies students in 277 grade 4, 7 and 9 classes in Oregon, USA.

Table 2.8 *Continued*

Study	Outcome Measures	Sample
Studies involving CES		
Trickett & Moos (1974)	Satisfaction and mood criteria	608 students in 18 classes, USA
Moos & Moos (1978)	Absences; grades	19 high school classes in one school, USA
Moos (1979a)	Indexes of student reactions	241 secondary school classes in various subject areas.
Fisher & Fraser (1983b)	Inquiry skills; attitudes	116 grade 8 and 9 science classes throughout Tasmania, Australia.
Galluzzi et. al (1980)	Psychological outcomes	414 grade 5 students in USA.
Humphrey (1984)	Self-control	750 grade 4 and 5 children in 36 classes, in USA.
Keyser & Barling (1981)	Academic self-efficacy beliefs	504 grade 6 children in South Africa.
Studies involving ICEQ		
Rentoul & Fraser (1980)	Inquiry skills; enjoyment	285 junior high school students in 1 science and social science classes in Sydney, Australia.
Wierstra (1984)	Attitudes; achievement	398 15-16 year old students in 9 classes in The Netherlands.
Wierstra et.al. (1987)	Attitudes; achievement	1105 secondary school students in 66 classes involved in Dutch option of Second International Science Study.
Fraser (1981); Fraser & Butts (1982)	Attitudes	Maximum of 712 students in 30 junior high high school science classes in Sydney, Australia.
Fraser, Nash & Fisher (1983)	Anxiety	116 grade 8 and 9 science classes throughout Tasmania, Australia.
Fraser & Fisher (1982a)	Inquiry Skills; attitudes	116 grade 8 and 9 science classes throughout Tasmania, Australia.

Table 2.8 *Continued*

Study	Outcome Measures	Sample
Studies involving MCI		
Fraser & Fisher (1982a, 1982c)	Inquiry Skills; understanding of nature of science; attitudes	2305 grade 7 science students in 100 classes in Tasmania, Australia.
Payne et. al (1974-75); Ellet et. al (1977)	Achievement; school attendance	6151 grade 4 students in 89 schools in Georgia, USA.
Fraser & O' Brien (1985)	Word knowledge; comprehension	758 grade 3 students in 32 classes in Sydney Australia.
Lawrenz (1988)	Energy knowledge; tow energy attitude scales	Approximately 1000 grade 4 and 7 students in 34 classes in Arizona, USA.
Studies involving CUCEI		
Fraser & Treagust (1986); Fraser, Treagust, & Dennis, (1986); Fraser, Treagust, Williamson, & Tobin (1987)	Satisfaction; locus of control	372 higher education students in 34 classes in various subject areas.
Studies involving other instruments		
Kelly (1980)	Achievements	41,657 students in 1735 schools in 14 developed countries in an IEA science study.
Johnson et. al (1981); Johnson et. al (1986); Slavin (1983a, b)	Different studies included; achievement; cross-ethnic relationships; cross-handicap relationships	Various samples involved in studies of cooperative learning strategies in subjects, especially USA.

Table 2.8 *Continued*

Study	Outcome Measures	Sample
Studies involving other instruments (continued)		
Talton (1983)	Attitude; achievement	1456 grade 10 biology students in 34 classes in various subject areas.
Perkins (1978)	Basic Skills	3703 grade 4 students in 42 elementary schools in a SE state in USA.
Brookover & Schneider (1975); Brookover et al. (1978, 1979)	Achievement	8078 grade 4 and 5 students in Michigan, USA
Gardner (1974, 1976)	Attitudes	1014 grade 11 physics students in 58 classes in Melbourne, Australia.
Payne et. al (1974-75)	Achievement	3350 elementary and 3613 secondary students in various subject areas and 1200 teachers in Georgia, USA.
Wubbels et. al (1988); Breklemams et al. (1990)	Achievement; attitudes	1105 secondary school students in 66 classes involved in Dutch option of Second International Science Study.
Giddings & Fraser (1990)	Attitudes	4643 senior high school and university students in 225 laboratory classes in Australia, USA, England, and Canada
Studies in developing countries		
Walberg, Singh, & Rasher (1977)	Achievement	3000 grade 10 science and social science students in 150 classes in Rajasthan, India.
Schibeci, Rideng, & Fraser (1987)	Attitudes	250 grade 11 biology students in six classes in Indonesia.
Paige (1978, 1979)	Achievement; individual modernity	1621 grade 6 students in 60 schools in East Java, Indonesia.
Holsinger (1972, 1973)	Information learning; individual modernity	2533 grade 3-5 students in 90 classes in Brazil.

Adapted and modified from Fraser (1994), Research on Classroom and School Climate

The perceptions of a positive environment that would be beneficial to learning is somewhat differently perceived by boys and girls. The associations between classroom environment and student outcomes with respect to gender is covered in detail in section 2.6. The sections that follow (Sections 2.6.2 and 2.6.3), discuss in detail the issue of gender and the classroom environment, and the effects on attitude towards science.

2.6 Gender Related Issues

2.6.1 *Introduction*

Numerous studies have been conducted on the issue of gender in science education. Each study seems to reinforce that girls are generally more disadvantaged in the study of science when compared with boys (Ingleton, 1995; Jegede & Okebukola, 1992; Kahle, 1996; Linn & Hyde, 1989; Stanley, 1996; Steinbeck & Gwizdala, 1995). The main reasons for this disadvantage, as argued by Stanley (1996) and Linn and Hyde (1989), were to the girls' lack of self-confidence and view-points on science. Harding (1996) and Kelly (1985) on the other hand, argued that science is inherently masculine. Kelly (1985) deduced this for the following reasons: the frequency of males choosing to study and work within the field; the way science is packaged for learning more towards boys via their connection to the real world; and, the behaviour patterns in class which facilitate learning for boys but restrict it for girls.

Welch (1985), reported in his studies that male students did better on concepts that were related to experimental design, modelling and hypotheses. Gender-related studies have also revealed that the construction of science textbooks and gender bias approaches used in science textbooks is one of the factors in the difficulties faced by girls in the learning of science (Guzzetti, 1996; Potter & Rosser, 1992).

2.6.2 *Gender Influence on the Classroom Environment*

As described earlier, research studies over the years have shown that appreciable learning can be attributed to the environment in which students are exposed to in their classrooms (Fraser & Walberg, 1991). Studies in the classroom have also shown that girls and boys differ in their perceptions of their classroom environment (e.g., Burkam, Lee, & Smerdon, 1997; Ferguson & Fraser, 1996; Henderson, Fisher, & Fraser, 1998; Lawrence, 1987; Rawnsley & Fisher, 1997; Riah & Fraser, 1999; Rickards, Fisher, & Fraser, 1997; Suarez, Pias, Membiela, & Dupia, 1998; Waldrip & Fisher, 1999).

Studies have shown consistently that female students perceive their teachers in a more positive way than do the male students in the same classrooms (Fraser, Giddings, & McRobbie, 1992, 1993; Fraser & Walberg, 1991; Henderson, Fisher, & Fraser, 1998; Lim, 1995; Riah & Fraser 1999; Rickards, Fisher & Fraser, 1997; Suarez, Pias, Membiela, & Dupia, 1998; Waldrip & Fisher, 1999; Wong & Fraser, 1994). Wong and Fraser (1994) however, found that male students learning in a science laboratory had more favourable perceptions of open ended activities than did female students. Research in general has suggested that boys and girls do react differently to science laboratory activities (Burkam, Lee, & Smerdon, 1997; Tobin & Garnett, 1987). Lim (1995) in his study of secondary school students found that male students perceived their classrooms as allowing greater opportunities for working at their own pace and time while female students viewed their science classrooms as opportunities to participate and have control of their own learning. Parker, Rennie, and Harding (1995) reinforced research done by Johnson and Johnson (1991) in showing that learning in science classrooms takes on a competitive nature and that boys prefer competitive and individualised learning, whereas girls prefer learning which involves cooperative models and mutual assistance. Similar findings were reported by Owens and Straton (1980) and Byrne, Hattie, and Fraser (1986). Johnson and Johnson (1991), however, showed that as students progressed to higher grades both male and female students seemed to gain more interest in competitive learning. Ferguson and Fraser (1996)

reported a similar finding in their study involving the transition of students from elementary schools to high schools in that the perceptions of both gender became closer together as they moved into higher level studies. This study, however, also revealed that boys were generally more negative in their perceptions of the environment at the elementary level compared with females. Female students' perceptions of the classroom generally deteriorated as they entered high school science classes.

There is also evidence that girls tend to participate less actively than boys in out-of class activities such as science competitions (Jones, 1991). Other research has showed that boys tend to dominate lessons as they are more vocal, seek and get more attention, call out answers and dominate the usage of experimental equipment (Guzzetti, 1996; Stanley, 1996; Steinback & Gwizdala, 1995; Tobin & Garnett, 1987).

In a study in The Netherlands involving the perceptions of students in a reality centred environment involving both Mathematics and Physics, some interesting findings were reported (Terwel, Brekelmans, Wubbels, & Eeden, 1994). In the mathematics environment, it was noted that the more girls there were in a class the lower the mean perception of cooperation. In other words, there was less cooperation and more distraction in classes with more girls than in classes with fewer girls. Girls perceived both the mathematics and physics classes as less reality-centered than did the boys. Girls also perceived less participation of students in general in the lessons. This was explained in terms that girls have a higher standard in judging classroom participation in comparison to their male counterparts.

Interestingly, data from the physics environment (Terwel, Brekelmans, Wubbels, & Eeden, 1994) revealed that girls perceived less cooperation and closeness between teachers and students than do boys adding further support to the different perceptions of the different gender (Goddard & Spear, 1987; Kahle, 1996). The work by Midgley,

Eccles, and Feldlaufer (1991), however, shows that boys and girls seem to be equally affected by the perceived warmth, friendliness and fairness of their teachers.

Studies by Steinback and Gwizdala (1995) showed that female students in single sex schools exhibited a significantly higher degree of self-confidence than those in mixed schools. Female students in a single-sex class indicated that the classroom atmosphere would change considerably if they were in a mixed-sex environment. These students indicated that they would feel intimidated, dumb, uncomfortable and hesitant in a mixed-sex classroom (Guzzetti, 1996; Steinback & Gwizdala, 1995).

Research has shown better achievement in classrooms could be achieved with greater cohesiveness, satisfaction and less disorganisation and friction (Fraser, 1989). Tamir and Caridnin (1993), using the findings of Fraser (1989), reported in their investigation of Arab schools that there were no significant differences between males and females in their perceptions of their learning environments. Tamir and Caridnin (1993) suggests the possible reasons for the non significant differences stem from the combination of greater cohesiveness, satisfaction, less disorganisation and friction, as well as, the non discrimination of the Arab system of boys and girls in their learning environments. Forgasz (1995) also reported that teacher quality, including support to individual students, especially to females, to be important variables that relate to students' achievement and learning in the science course, mathematics. The study also revealed that the teachers' personal interest in the students encouraged active participation and promoted the development of students' investigative skills.

It is evident that studies have shown that different gender perceive their actual or preferred classroom environments differently. However, there is a dilemma faced by teachers with the differing perceptions when the classes are coeducational. This is because boys and girls perceive their preferred environment differently and to make the learning environment more in line with the preferred environment with both boys and girls present could in fact not be equally advantageous for male and female

students (Fraser, Giddings, & McRobbie, 1993; Fraser & Tobin, 1991; Henderson, Fisher, & Fraser, 1995).

2.6.3 *Gender Differences in Attitude towards Science*

Attitude to science can be defined as

> satisfaction in learning science at school, adoption of attributes like open-mindedness and attitudes to scientists as people (Fraser, 1978a, p. 71).

Numerous studies pertaining to the relationship between student attitudes and achievement with respect to aspects of science, gender and the learning environment have been investigated (Burkam, Lee, & Smerdon, 1997; Fraser, 1978a ; Greenfield, 1996; Plucker 1996). The promotion of positive attitudes in science classrooms is seen to be an important aim and studies to date show that a positive learning environment creates a positive attitude for learning. Complementing this is Mager's (1968) research where three possible reasons for promoting positive attitudes in students are outlined. First, research has shown that there are positive associations between student attitudes and achievement. Second, a positive attitude is more likely to sustain interest in the field of study in the future and, finally, peers are influenced by the attitudes of others.

Fraser (1978a) found that boys enjoyed science lessons more than did girls. Teachers also believed that boys were more interested, more confident and had higher levels of achievement in science and mathematics than did girls (Plucker, 1996). Kelly (1985) also found that girls had less favourable attitudes towards science. However, a study by Greenfield (1996) in schools in Hawaii did not find any significant gender-related differences in student attitudes. Participation in sciences from senior secondary to tertiary levels have been found to be persistently lower for females than for males (Forgasz, 1995; Young & Fraser, 1994). Supporting this lack of participation is the study where girls were found generally to dislike Physics (Brekelmans, Levy &

Rodriguez, 1993). However, research does indicate that girls are showing more interest in science although their enrolments in science courses is still proportionally less than boys (Campbell, 1993). Gender-related differences in attitude and participation could be best summarised by Schibeci (1984) where he writes:

> We must bear in mind...the importance of distinguishing between physical and biological science when sex differences in attitudes are considered .....males are generally more positive toward the physical sciences than females (p. 33).

Keeves and Kotte (1996) argued that boys in some countries expressed more favourable attitudes concerning the ease of learning science while girls were found in general to have an attitude that school learning was easier, with the exception of science subjects. This study also revealed that attitude to science was associated with the years of schooling. The study found that the differences in attitude towards science increased with age with more favourable attitudes being shown by boys.

On the other hand, Fleming and Malone (1983) showed that males had a more positive attitude than females at the primary and secondary levels whereas the trend was reversed in the lower secondary levels. This finding was supported by the study of Linn and Hyde (1989) where interest in the science and mathematics was greater in males than in females.

Attitudes towards the learning of sciences have also been related to teacher involvement, behaviour and interactions with their students (Plucker, 1996). Frogasz (1995) reported that both female and male students were found to perform better in mathematics when teacher quality and support was good. Studies have also revealed that the teaching approaches used in classes seem to relate to the attitudes expressed in the science classes. Baker, Leary, and Trammel (1992) reported that student-centred classrooms appear to be less likely to promote positive attitudes towards science for

girls and that teacher centered classrooms were associated with boys holding negative attitudes about girls in science.

The attitude towards science has also been studied using other variables. Baker (1992) investigated attitudes towards science of students in grades 2, 5, 8 and 11. The study sampled from two high schools, three middle schools and three elementary schools comprised three parts; classroom structure, attitude toward science and a sentence completion test. With respect to gender, the gap between the sexes on science attitude decreased as students went to the higher grades. There was, however, an unusual interaction between the different gender and the classroom structure. Females in teacher-centered classrooms were less likely not to consider science as a career in comparison with boys. Females were also concerned more than boys about the 'niceness' of the teacher.

On the whole, past research has clearly shown that male students generally have a more positive attitude towards science than do female students, but it must be emphasised that these differences are usually small.

2.7 Summary

This chapter has reviewed research related to classroom learning environment and the use of the questionnaires in this research. Particular emphasis is placed on tertiary environments and on studies relating to the classroom environment when transition from one level of education to another occurs. From this review the following points have emerged:

- The study of learning environments is important in the spectrum of education.

- A variety of questionnaires are available with which to measure classroom environments.

- Very few studies involving tertiary-level classroom environments have been carried out.

- Students' and teachers' perceptions of the classroom environment are reliable predictors of learning outcomes.

- There are apparent differences in perceptions when students move between educational levels.

- Classroom environments are perceived differently by boys and girls.

- Teacher perceptions of classroom environments are generally more favourable than those of students.

- Boys seem to have a more positive attitude towards science.

- The CUCEI is the most suitable instrument for the study of classroom environments in the final year of secondary school and in the first year of university studies.

The effectiveness of classroom environment is best summarised by the work of Fraser (1986a) where he states that,

> classroom environment is such a potent determinant of student outcomes that it should not be ignored by those wishing to improve the effectiveness of the schools (p. 1).

2.8 Conclusion

The literature review showed there was abundant research at the primary and secondary level and there was a need for more studies of the classroom environment at the tertiary level. This study is unique for the following reasons:

a) it is the first classroom environment research study involving students both in the high schools and first year university level in Northwest British Columbia, Canada;

b) the study focuses on the perceptions of the classroom environment of students moving from their final year of high school to the first year of university work at a community college;

c) the modified and personal form of the CUCEI has never been used for a study prior to this research, and this is the first instance that this instrument has been used in higher education settings.

The next chapter discusses in detail the methodology applied in this research along with the modifications that were made to the original CUCEI developed by Fraser, Treagust, and Dennis (1986).

CHAPTER 3

METHODOLOGY

3.1 Introduction

The previous chapter was primarily devoted to a review of literature in the field of classroom learning environments and provided further justification of the need for this study. This chapter describes the methodology that was employed in the present research to ascertain the psychosocial environment of students as they progress from one level of study to the next.

An important focus of this chapter is the classroom environment questionnaire which was adapted and modified for this study. The first section is a discussion of the development and validation of the original CUCEI. The modified form of the CUCEI utilised for this study along with a detailed description and justification for the choice of scales can be found in section 3.3. Sections 3.4 and 3.5 discuss the justification of the scales used for the assessment of students' attitudes, and the method and procedures followed for data collection. The sample for the study, data entry and analysis of data follow in sections 3.6, 3.7 and 3.8. Finally, a summary of this chapter can be found in section 3.9.

3.2 The Original CUCEI

3.2.1 *Descriptive Information of Scales*

The CUCEI was first developed in 1986 for use in upper secondary and university classrooms (Fraser, Treagust, & Dennis, 1986; Fraser, Treagust, Williamson, & Tobin, 1987). Four versions of the instrument were designed, actual and preferred versions for students and actual and preferred versions for the instructors. Each version of the CUCEI has 49 items, with seven items in each of the seven scales. However, the questionnaires differ in the way the items are phrased. In the preferred forms, the statements request the participants to indicate what they would like in an ideal classroom whereas the actual version measures the actual environment of the classroom as perceived by the participants. Table 3.1 shows examples of the wording differences. The teacher versions are available in order to gain an insight into teacher perceptions of actual and preferred environments.

Table 3.1
Wording Difference in the Actual and Preferred Form of the CUCEI

Scale	Actual Form	Preferred Form
Personalisation	The instructor goes out of his/ her way to help students. (+)	The instructor would go out of his/her way to help students. (+)
Task Orientation	Students know exactly what has to be done in our class. (+)	Students would know exactly what has to be done in our class. (+)
Innovation	New and different ways of teaching are seldom used in this class.(-)	New and different ways of teaching would seldom be used in the class. (-)

(-) designation are reversed scored

The seven scales of the CUCEI are Personalisation, Involvement, Student Cohesiveness, Satisfaction, Task Orientation, Innovation and Individualisation. Table 3.2 shows the classification of each scale of the CUCEI based on Moos' (1979) theory along with descriptive information for each scale. Each item in each of the scales is responded to according to the alternatives of Strongly Agree, Agree, Disagree and Strongly Disagree. Some of the items are reversed in polarity and the scoring is reversed for these items.

Table 3.2
Descriptive Information for the Original Scales in the CUCEI

Scale Name	Moos Category	Scale description
Personalisation	R	Emphasis on opportunities for individual students to interact with the instructor and on concern for students' personal welfare.
Involvement	R	Extent to which students participate actively and attentively in class discussions and activities
Student Cohesiveness	R	Extent to which students know, help and are friendly towards each other.
Satisfaction	R	Extent of enjoyment of classes.
Task Orientation	P	Extent to which class activities are clear and well organised.
Innovation	S	Extent to which the instructor plans new, unusual class activities, teaching techniques and assignments.
Individualisation	S	Extent to which students are allowed to make decisions and are treated differently according to ability, interests and rate of working.

The categories: R: Relationship Dimension, P: Personal Development Dimension, S: System Maintenance and System Change Dimension

Source: Fraser, Treagust, and Dennis (1986)

3.2.2 *Reliability and Validity of the Original CUCEI*

In keeping with past traditions in classroom environment research, the validation of the CUCEI involved three statistical values. Firstly, the Cronbach alpha coefficient, which measures the internal consistency of the scales, in other words, the extent to which items in the same scale measure the same dimension. Secondly, when validating most classroom environment instruments, measurements are made of each scale's discriminant validity. This is a measure of the extent to which the scale measures a dimension unique from that measured by any other scale. Finally, another feature considered important in the design of any classroom environment instrument is the ability of a scale to differentiate between classrooms. This feature is important because, students in the same class should perceive their learning environment in a similar way while students in different classes would perceive their classroom environment somewhat differently, whether it is the same course with the same teacher or in other course work with a different teacher. This feature is tested by a one way ANOVA using class membership as the main effect.

The CUCEI developed by Fraser, Treagust, and Dennis (1986) was put through this rigorous validation process. The CUCEI was initially validated with a sample of 127 Australian students in ten classes. Further, the instrument was also cross-validated with three other samples, namely a larger Australian sample, a sample of American students and a sample of instructors. The larger Australian sample consisted of 307 students in 30 postgraduate and undergraduate classes in a variety of disciplines. The American sample consisted of 65 postgraduate and undergraduate students. Sixteen Australians and four Americans teaching 34 classes made up the sample for the instructors. The field testing of this instrument in the USA and Australia confirmed the reliability and validity of this instrument (Fraser, Treagust, & Dennis, 1986; Fraser, Treagust, Williamson, & Tobin, 1987).

The figures in Table 3.3 indicate that Cronbach alpha coefficients range between 0.70 and 0.90 for the actual version and 0.63 to 0.82 for the preferred version when the individual student was used as the unit of analysis and between 0.81 and 0.96 for the actual version and 0.78 to 0.90 for the preferred form when the class was used as the unit of analysis. In the instructor version and using the individual as the unit of analysis the Cronbach alpha coefficients ranges between 0.53 to 0.83 for the actual version and between 0.55 to 0.82 for the preferred version.

Table 3.3
Internal Consistency Reliability (Alpha Coefficient) of the CUCEI

Scale	Unit of Analysis	Alpha Reliability			
		Student		Instructor	
		Actual	Preferred	Actual	Preferred
Personalisation	Individual	0.75	0.68	0.60	0.67
	Class	0.85	0.81		
Involvement	Individual	0.70	0.65	0.54	0.76
	Class	0.81	0.79		
Student Cohesiveness	Individual	0.90	0.78	0.83	0.70
	Class	0.95	0.90		
Satisfaction	Individual	0.88	0.82	0.53	0.82
	Class	0.96	0.90		
Task Orientation	Individual	0.75	0.63	0.74	0.77
	Class	0.85	0.78		
Innovation	Individual	0.81	0.70	0.55	0.55
	Class	0.93	0.82		
Individualisation	Individual	0.78	0.67	0.83	0.82
	Class	0.89	0.80		

Source: *Fraser, Treagust, Williamson, and Tobin (1987)*

Table 3.4 shows the discriminant validity (using the mean correlation of a scale with the other six scales as a convenient index) for the four versions of the CUCEI. The values for the actual version ranged from 0.34 to 0.47 when the individual

student was used as the unit of analysis whereas when the unit of analysis was the class, the values were higher. The values suggest that there is some overlap in what the scales measure, however, they suggest that the CUCEI scale had adequate discriminant validity for use in its actual and preferred forms whether it is with students or instructors.

Table 3.4
Discriminant Validity (Mean Correlation with other six scales) for Two Units of Analysis and ANOVA Results (eta² statistics and significance level) for the CUCEI.

Scale & Unit of Analysis	Discriminant Validity				ANOVA
	Student		Instructor		Student Actual
	Actual	Preferred	Actual	Preferred	eta²
Personalisation					
Individual	0.46	0.42	0.28	0.32	0.35*
Class	0.53	0.50			
Involvement					
Individual	0.47	0.41	0.34	0.44	0.40*
Class	0.56	0.55			
Student Cohesiveness					
Individual	0.45	0.39	0.29	0.38	0.47*
Class	0.48	0.44			
Satisfaction					
Individual	0.45	0.40	0.14	0.25	0.32*
Class	0.53	0.57			
Task Orientation					
Individual	0.38	0.33	0.40	0.26	0.43*
Class	0.41	0.38			
Innovation					
Individual	0.46	0.41	0.24	0.15	0.41*
Class	0.53	0.50			
Individualisation					
Individual	0.34	0.32	0.35	0.25	0.46*
Class	0.36	0.36			

* $p<0.001$ Source: *Fraser, Treagust, Williamson, and Tobin (1987)*

Finally, the student actual form of the instrument was found capable of differentiating between the perceptions of students in different classrooms (see Table 3.4). In other words, students within the same class perceived it relatively similarly, while the mean within-class perceptions varied from class to class. This was checked by performing a one way ANOVA which showed the eta^2 statistic, which is the estimate of variance in CUCEI scores attributable to class membership, was significant and ranged from 32% of variance for the Satisfaction scale to 47% for Student Cohesiveness.

3.3 The Revised Form of the CUCEI

The CUCEI version used in this study was modified in three ways. Firstly, the actual and preferred versions of the questionnaire were personalised. Secondly, only five of the seven original scales were used and two new scales were included. Finally, the existing four response alternatives of Strongly Agree, Agree, Disagree and Strongly Disagree were replaced with a five-point Likert Scale with alternative responses Almost Never, Seldom, Sometimes, Often and Almost Always. The scoring of some of the items was reversed as in the original CUCEI.

3.3.1 *Personal Form*

The studies by Fraser, Fisher, and McRobbie (1996) and Fraser, Giddings, and McRobbie (1992) have shown the effectiveness of the personal version of a questionnaire. In 1991, Fraser and Tobin pointed out that there was potentially a major problem with all existing classroom environment instruments in that items were worded in such a way that they elicited students' perceptions of a class as a whole as distinct from the students' perceptions of his/her role within the class. Fraser and Tobin (1991) also reported the personalised form of instruments to be more sensitive to gender related investigations as well as in individualised case studies.

As the primary focus of this research thesis was based on the individual student and instructor perceptions, the CUCEI used in this study included this personalised feature that was utilised in the studies by Fraser, Fisher, and McRobbie (1996), and Fraser, Giddings, and McRobbie (1992), and Fraser and Tobin (1991). In addition, the research work carried out for this thesis also focused on the variation of perceptions of male and female students in their science classes thus making the personalised form more appropriate.

Table 3.5
Differences in the Wording of Items in the Modified and Personalised Form of the CUCEI

Scale	Original CUCEI	Modified and Personalised CUCEI
Task Orientation	Class assignments are clear so everyone knows what to do.	Class assignments are clear and I know what to do.
Personalisation	The instructor goes out of his/her way to help students.	The instructor goes out of his/her way to help me.
Individualisation	Students are allowed to choose activities and how they will work.	I am allowed to choose activities and how I will work.
Innovation	Students seem to do the same type of activities in every class.	I seem to do the same type of activities in every class.

Each item in the five scales adapted from the original CUCEI was reworded to the personal approach. Table 3.5 below, illustrates how the changes were made to personalise the items of the CUCEI by presenting some examples. The remaining items in the two new scales adapted to form the modified CUCEI were selected from the WIHIC (Fraser, Fisher, & McRobbie, 1996).

3.3.2 *Scale Modifications*

The number of scales in the CUCEI was maintained at seven with each scale having seven items. In the original, CUCEI the items appeared in the questionnaire in a cyclical manner. In the modified version all items were grouped in their appropriate scales, that is seven items all belonging to the same scale appeared in one block. This was done in order to make it easier for scoring purposes and also in keeping with recent developments (e.g., Fraser, Fisher, & McRobbie, 1996; Fraser, Giddings, & McRobbie, 1992).

Of the original seven scales, only five remained in this modified version. The five scales that remained were Personalisation, Innovation, Student Cohesiveness, Task Orientation and Individualisation. The two scales that were omitted for this study were the Satisfaction and Involvement scales. The Involvement scale was replaced by seven items from the WIHIC Cooperation scale. Apart from the introduction of the Cooperation scale, the other new scale incorporated into the instrument was the Equity scale also form the WIHIC. Both these scales were adapted and chosen from the study encompassing personal forms (Fraser, Fisher, & McRobbie, 1996). The Satisfaction scale from the original CUCEI was modified and incorporated in the latter part of this study where attitudes of students were investigated.

Table 3.6 lists the seven scales in the final version of the modified CUCEI together with a scale description and classification according to Moos' dimensions.

Table 3.6
Descriptive Information for the Modified CUCEI

Scale Name	Description	Moos' Classification
Personalisation	Extent of opportunities for individual students to interact with the instructor and on concern for students personal welfare.	*Relationship*
Innovation *Maintenance*	Extent to which the instructor plans new, unusual activities, teaching techniques and assignments.	*System and System Change*
Student Cohesiveness	Extent to which students know, help and are friendly towards each other.	*Relationship*
Task Orientation	Extent to which class activities are clear and well organised.	*Personal Development*
Individualisation *Maintenance*	Extent to which students are allowed to make decisions and are treated differently according to ability, interests and rate of working.	*System and System Change*
Cooperation	Extent to which students cooperate rather than compete with one another on learning tasks.	*Personal Development*
Equity *Maintenance*	Extent to which students are treated equally by the teacher	*System and System Change*

3.3.3 *Justification for Choice of Scales*

The seven scales were chosen because

Firstly, they provided coverage of the three general categories of dimensions identified by Moos (1974).

Secondly, the modification to the original CUCEI ensured a more even distribution of the dimensions, with three scales representing the System Maintenance and System Change dimension and two scales each representing each of the other two dimensions, Relationship and Personal Development (see Table 3.6).

Thirdly, the Equity scale was included so as to gauge the students' perceptions of the environment with respect to gender. This scale measured the extent to which students are treated equally by their instructors. This scale was considered an important addition as considerable work that has been carried out with respect to gender and science education showed that male and female students perceived their environment differently and that they perceived being treated differently in their classrooms (e.g., Ferguson & Fraser, 1997; Rickards, Fisher & Fraser, 1997; Suarez, Pias, Membiela, & Dupia, 1998). Section 2.8, in Chapter 2 of this thesis discusses these findings and indicates the importance of a scale such as Equity.

Fourth, the Cooperation scale was included as one of the seven scales because the levels of cooperation seem to change as students proceed to higher levels of education. Midgley (1991) and fellow researchers showed that there was a decrease in opportunities for cooperation and interaction among students after transition. Owen and Straton (1980) on the other hand showed that female students appeared to show a greater preference for cooperation than did male students. These findings were discussed in detail in Section 2.5 of this thesis. Furthermore, the researcher viewed this scale as being particularly relevant to higher level studies as it measures the extent to which students cooperate rather than compete with one another on learning tasks. Apart from this, there is considerable support for the cooperative model in learning environments (Cooper, 1995a, b; Vahala & Winston, 1994).

Finally, these seven scales in the modified form of the CUCEI are seen as important dimensions for the present study. Studies with the CUCEI have shown the instrument to be effective in measuring the perceptions of students at the tertiary level (Fisher & Parkinson, 1998; Fraser, Treagust, Williamson, & Tobin, 1987; Marcelo, 1988; Winston, Vahala, Nichols, Wintrow, & Rome, 1994). The CUCEI was developed for small classes and all tertiary classes at Northwest Community College do not exceed 36 students. Thus, the modified version of the CUCEI was used in a Canadian institution for the first time. The importance and need for the two new scales have been covered in the above subsections. The Innovation scale is

important in the study as one of the objectives of this study is to examine if the changed teaching strategy employed by some science instructors at the college has contributed to a better learning environment in the classroom. The Individualisation, Personalisation, and Task Orientation scales are considered important as university courses do not usually take into account the different abilities, rate of working and interests of students. In some instances the courses are perceived not to be organised and show a decrease in student/instructor positive interactions. For example, Killen (1994) reported that students perceived that their failure in university studies was caused by lecturers who are out of touch with students' needs, too many demands on students' time, inappropriate assessment procedures, heavy course workload and lecturers' unrealistically high expectations of students.

3.3.4 *Reliability of the Other Scales used in this Study*

The two scales adapted from the research work of Fraser, Fisher, and McRobbie (1996) for the present study, the Cooperation and Equity scales had very high reported Cronbach alpha reliabilities of 0.77 to 0.84 respectively.

3.3.5 *Item Scoring in Each Scale*

The items in the original version of the CUCEI were responded to with four response alternatives of Strongly Agree, Agree, Disagree & Strongly Disagree. Later the responses were transposed to numerical values in the following manner; a score of 4 for Strongly Agree to a minimum score of 1 for a response of Strongly Disagree. Some of the items were reversed in polarity, that is the scoring is reversed for these items.

In keeping with recent developments in the design of learning environment questionnaires, the modified form of the instrument used in this study employed a five-point Likert response scale where each item is responded to with the alternatives of Almost Never, Seldom, Sometimes, Often and Almost Always

instead of the four-point Likert response system utilised in the original CUCEI. The use of the five-point Likert scale was thought to give participants a greater choice in their responses. In addition, the five-point response is also considered to better represent the personalised nature of the questionnaire (Fraser, Fisher, & McRobbie, 1996). The scoring of some of the items were reversed in this modified version of the CUCEI. The response alternative Almost Never was scored 1, Seldom 2, Sometimes 3, Often 4 and Almost Always 5. In the reversed items the scoring was reversed in that the range was a score of 5 for Almost Never to a score of 1 for Almost Always.

3.4 Assessment of Students' Attitudes

In this study three particular scales were chosen to measure student attitudes to science: two from the LEI and one from the original CUCEI. The three scales which were chosen and modified to the personal form were Difficulty, Speed and Satisfaction scales. Table 3.7 shows the three scales in this phase of the research.

Table 3.7
Descriptive Information of Scales Used to Measure Satisfaction, Difficulty and Speed in Science Course Work

Scale Name	Description	Example Items
Satisfaction	Extent of enjoyment of classes.	I look forward to coming to this class.
Difficulty	Extent to which students find difficulty with the work in the class.	I find the work in this class difficult.
Speed	Extent to which class work is covered quickly.	The pace in this class is rushed.

Each scale has seven items with the response alternatives of Strongly Agree, Agree, Disagree and Strongly Disagree. Some items in the three scales had their polarity reversed.

3.4.1 *Justification for Choice of Attitudinal Scales*

The three scales in the attitudinal measure were selected, adapted and modified in order to enable the researcher to ascertain if there are major changes in these dimensions when the students moved from one level of studies to the next. Studies have shown that in general satisfaction is perceived to be lower when students moved to a higher level of study (Ferguson & Fraser, 1996; Fraser, 1989; Fraser, Treagust, Williamson, & Tobin, 1987; Midgley, Eccles, & Feldlaufer, 1991; Moos, 1979).

The dimensions of difficulty and speed were of concern in this study because of the researcher's observations, and feedback from fellow instructors at the college, of students facing difficulty with class work when they arrive from secondary school. Research has shown that students transiting from primary to secondary sciences found that they could hardly recognise the subjects in comparison to those taken at the primary level (Jarman, 1990). This was a result of the substantial changes in the teaching and learning of science they experienced in their move to the higher level of studies. Further support for the difficulty students faced can be found in Booth's (1997) recent work with students entering university studies.

The increased speed of courses has been a constant source of 'complaint' by students as they move to higher class levels. From personal experience, students have very often found classes in the first year of university to be too fast with too much material covered in a short time period when compared with that of their high schools. Research work carried out by Killen (1994) suggests that the instructors are out of touch with student needs in terms of the heavy workloads, the extensive demands on students' time and the unrealistic high expectations placed on students by their instructors. Similar findings have also been reported by Ramsden (1991) and Vahala and Winston (1994).

Finally, all three scales were perceived as suitable to the classrooms at the post secondary level where a 'guided' approach to instruction is being practised. Feedback from students over the years has generally shown the 'guided' approach to alleviate difficulty and speed and increase overall satisfaction in the courses students were taking.

3.4.2 *Scoring*

The four response alternatives in the attitudinal measures were scored in the following way: 4-Strongly Agree, 3-Agree, 2- Disagree, 1-Strongly Disagree. The scores were reversed for negative items. Items which were omitted or not responded to were scored as 2.5.

3.5 Qualitative vs Quantitative Data

Most studies in science education seem to utilise either a quantitative or a qualitative approach. Cook and Reichardt (1979) define quantitative research methods to include randomised experiments, quasi-experiments, paper and pencil 'objective' tests, multivariate statistical analysis and the like, while qualitative analysis include methods that employ case studies, in depth interviews, participant observations and ethnography. Researchers over the last few decades have placed greater emphasis on either forms of research though in recent times there has been a move towards complementing quantitative research with qualitative approaches (Fraser, 1998a).

Tobin, Kahle, and Fraser (1990) focused on higher-level cognitive learning in grade 10 science classes involving two high school teachers and six researchers using interpretative research methods over a period of 12 weeks. The qualitative aspect of the study involved classroom observations, student and teacher interviews on a daily basis, and the examination of students' written work. Quantitative information was

collected from selected scales from the Individualised Classroom Environment Questionnaire (Fraser, 1990) and the classroom Environment Scale (Moos & Trickett, 1987). The data from the study showed that student mind frames were influenced by teacher mind frames through classroom practices. One important outcome in the study was that quantitative data enabled the researchers to use statistical analysis to test assertions based on qualitative information. Overall the study attests to the value of using qualitative and quantitative methods together in classroom environment research. Qualitative analysis used in conjunction with classroom environment instruments provide salient insights into aspects of the environment which are not captured quantitatively (Fraser & Tobin, 1991).

Fraser (1991) reported on the case study of 15 exemplary science teachers from schools in Perth, Australia. The study encompassed both research approaches and illustrated the effects of the combination of these two types of approaches in research projects. Templeton and Jensen (1993) further investigated this feature but this time with an emphasis on the school environment through the eyes of successful school teachers who had received the National and State Teacher of the Year (NSTOY) awards in the USA. All information that was gathered and analysed was found to collaborate with findings in the qualitative studies. The qualitative data obtained shed light on numerous areas. For example, the favourable classroom environment observed in the classrooms of exemplary teachers by researchers was also reflected in quantitative data obtained from the dimensions of the Classroom Environment Scale (CES).

Twelve male and three female science teachers from two coeducational high schools in Perth, Australia took part in a study on the nature and role of target students in the classroom (Fraser & Tobin, 1991). Target students were defined as:

> those who experience a different learning environment from other students in that they are involved in markedly greater proportion of the whole-class interactions with the teacher than are their classmates (p. 281).

The qualitative aspect of the investigation involved data from field notes of classroom observations of 200 grade 8-12 science lessons, written self report data on student engagement, questionnaire data from teachers and interviews with teachers and students. The quantitative aspect involved the assessment of students' perceptions of the classroom using the short form of the Classroom Environment Scale (CES) (Fraser 1986). The whole study took 18 weeks, six weeks with nine teachers in a Private coeducational high school and another 12 weeks with six teachers from a Public School. The results from the study revealed a sensitive finding in that teachers should become more aware of the existence of the target student phenomenon and understand how it leads to the inequitable treatment of students. Qualitative analysis used in conjunction with quantitative data from the classroom environment instrument complemented aspects of the environment which were not captured quantitatively.

Fraser (1996) focused on a multilevel study of the learning environment of a grade 10 science class in Western Australia incorporating a teacher-researcher perspective as well as that of six university-based researchers. Qualitative methods involved in this study were; classroom observations, the examination of student diaries, interviews with the teacher-researcher, students, school administrators, and parents; video taping of classroom activities, team meetings involving all researchers and teacher-researcher three times a week and several researchers visiting the class four times per week for a period of five weeks. The qualitative component of the study was complemented by a quantitative component involving the use of a questionnaire, a modified form of the Constructivist Learning Environment Survey (CLES). The study provided important insights into ways to promote or impede a favourable classroom environment by the school climate, teacher beliefs, and various constraints such as the prescribed curriculum and the school timetable. Another example, a recent study of a multilevel classroom environment having quantitative and qualitative components, can be found in the research work of Waxman, Huang, and Wang (1996).

Thus, in recent years, educational researchers have found merit in complementing their studies with both a qualitative and quantitative component as exemplified by the above studies. This trend is seen in an increasing number of studies (Baker, 1992; Dorman, Fraser, & McRobbie, 1994; Fraser & Hoffman, 1995; Fraser & Maor, 1993; Fraser & Tobin,1991; Ramsden, 1991; Templeton & Jensen, 1993; Tobin & Fraser, 1998; Tobin, Kahle, & Fraser, 1990; Villar, 1994; Waldrip & Fisher,1998; Waxman, Huang, & Wang, 1996).

The development of personal forms of the learning environment questionnaires has now resulted in the ability to draw a greater understanding of the data as the feedback obtained from the instruments is based on the individual's perceptions of the learning environment. Studies in the use of the personal forms have shown that the qualitative data and the quantitative complement each other very well (Fraser, Fisher, & McRobbie, 1996, Fraser, Giddings, & McRobbie, 1995; Zandvliet & Fraser, 1998).

Both qualitative and quantitative data were used in this research study. Quantitative data were obtained from the questionnaire and then analysed. Qualitative data were obtained from class observations and interviews with students and instructors.

3.5.1 *Quantitative Data*

The questionnaire was first administered at the local senior secondary schools in the last few weeks of their final term. In the fall of the new academic year at the post secondary level, the questionnaires were administered at the college where a good proportion of students who had first completed the questionnaire in their respective senior secondary schools proceeded on from their high schools to pursue their first two years of university work. The questionnaire was administered after students experienced at least eight weeks of classes. This is because previous research has indicated that students seem to bond with the teacher and gain a better understanding of their environment only after some period of exposure to their new

environment (Fraser, 1998a). The actual version was administered first followed a week later by the preferred form.

When the actual version of the CUCEI was administered, the three-scale attitude measure was also given to the students. A copy of the CUCEI, actual and preferred versions, along with the three-scale attitudinal measure can be found in Appendix A, B, C, and D.

In order to provide feedback to teachers regarding the responses of their students, students were requested to provide their teacher's name. Students were given the option to provide their names if they wished so that if they decided to volunteer for the quantitative part of this research, relevant questions concerning their input could be raised. The sex of each student was also requested as this study also investigated the environment as perceived by the different sexes. Also, the age of the student was requested as there were some mature students returning to study at the university level and age has been shown to influence how students perceive their classroom environment (Hofstein & Welch, 1984; Keeves & Kotes, 1996; Yager & Penick, 1986, Yager & Yager, 1985).

Questionnaires which were not completed by either lack of motivation of the participants or just by the lack of time were discarded. In some classes, there were problems related to absences and as such there were more questionnaires collected in one form of the questionnaire compared with the other.

3.5.2 *Qualitative Data for Research*

In order to achieve the qualitative aspect for this study, volunteers were sought at the post secondary level to take part in an interview regarding their perceptions of the classroom environment. Three students were picked from the volunteers and interviewed. These students had previously completed the questionnaire when they were studying at their respective senior secondary schools. The students were

selected so as to represent the student population, from high achievers to those who faced some difficulties in their science courses. Three instructors from the different science disciplines in the college were also interviewed. The group of instructors chosen taught six different classes which covered the academic subjects of Physics, Biology, Calculus and Computers. Instructors were asked numerous questions, some of which dealt with their expectations in their classroom, others with the teaching techniques they utilised in their courses and still others with the general classroom environment they had and expected.

In addition to the interviews, the researcher conducted in classroom observations. Three classes, Biology, Physics and Computer Science classes with the three different instructors involved in the study were observed. Each observation was for a period which ranged from an hour for the Physics class to one and a half hours for the Biology and Computer Science classes. Classroom observations were employed in order to gain a further insight into students' reactions to the teaching methods employed in the class as well as to gauge the classroom environment in the respective classrooms

3.6 The sample

A total of 504 students participated in the study which covered the subjects of Biology, Chemistry, Physics, Computers and Mathematics. Out of the sample size of 504 students, there was a total of 205 participants from Canadian institutions, of which 99 were female and 106 were male. The remaining 299 students, all male, came from Australian institutions. A total of 24 instructors took part in this study as well.

Data were collected from Australian institutions in order to establish a good sample size for the validation process of the modified personal form of the CUCEI. The 299

students came from two all-male senior secondary colleges in the Australian Capital Territory, Australia.

Both students and teachers completed actual and preferred forms of the instrument, but only the students completed the attitudinal measure.

3.7 Data Entry

Student responses to the CUCEI and the attitude measure were entered class by class on an Excel spread sheet. Appropriate items were reverse-scored. Each school and higher institution that participated in this study was identified by a numbered code, and each student was identified in their respective classes.

The confidentiality assured to each student and teacher was maintained. Individual student and teacher responses to the questionnaire was sighted by the researcher and remain in storage in the researcher's care. The identity of teachers and students was encoded during entry into the spread sheet in order to preserve the anonymity of the participants and maintain the standards required by research ethics.

Quantitative data were analysed using an SPSS statistical package (Norusis, 1993). The data analysed were grouped on an individual and class basis. Correlation and regression analyses on all data on a student-by-student basis were performed with this program. Alpha reliability and discriminant validity figures for both questionnaires, the actual and preferred forms, were also analysed with the SPSS package. The results obtained from this study were transferred to another statistical package, STATISTICA version 4.1 (StatSoft, 1991) and the graphs were a result of the use of this package.

The research data were analysed using both units of analysis, the individual student and the class mean. This approach allowed the researcher to compare his findings with previous research involving the use of classroom environment questionnaires.

Interviews with three instructors and students were taped and later transcribed and used to complement the quantitative data which were obtained via the questionnaires. Notes were taken during the classroom observations and these are included in Section 5.7 of this thesis. All original tapes and notes for this part of the research are in the possession of the researcher.

3.8 Summary

This chapter is devoted to the methodology and development of the questionnaire that was appropriate for this study. Almost all students and teachers who participated in the research completed an actual and preferred version of the modified form of the College and Universities Classroom Inventory, (CUCEI). The chapter on the whole covers the established validity and reliability of the CUCEI developed by Fraser, Treagust, and Dennis (1986), and the modifications that were made to this instrument in this study.

Furthermore, data were also collected about the students perceived satisfaction and difficulty with the course and the speed at which the course work was covered.

This chapter also outlines the procedures followed to collect and analyse data. The research work in this thesis also utilises qualitative data to supplement the quantitative data provided by the questionnaires. The integration of the qualitative data with quantitative data is discussed in Chapter 5.

The next chapter, Chapter 4 of this thesis, investigates and discusses the validity and reliability of the modified instrument, the CUCEI, used for this study, as well as the attitudinal scales.

CHAPTER 4

VALIDATION OF THE LEARNING ENVIRONMENT INSTRUMENT AND THE ATTITUDINAL MEASURES

4.1 Introduction

One objective of this study was to validate the modified and personalised form of the CUCEI. Previous research, reviewed in Chapters 2 and 3 of this thesis, has indicated that the original CUCEI was acceptable as an instrument to be used at upper secondary and tertiary levels (Fraser, Treagust, & Dennis, 1986). Further, the personalising of learning environment instruments has also contributed to better feedback from participants (Fraser, Fisher, & McRobbie, 1996; Fraser, Giddings, & McRobbie, 1992). The personal form has also been found to be more sensitive to gender related investigations as well as individualised case studies (Fraser & Tobin, 1991).

In this chapter descriptive statistics are used to confirm the validity and reliability of the CUCEI and the three additional measures namely, Satisfaction, Speed and Difficulty.

4.2 Reliability and Validity of the CUCEI and the Additional Scales

4.2.1 *The College and Universities Classroom Environment Inventory (CUCEI)*

4.2.1.1 *Factor Analysis*

Table 4.1 below shows the factor loadings obtained when the individual was used as the unit of analysis for the actual version with the total sample from the senior secondary schools and the post secondary institute. A principal components factor analysis, followed by varimax rotation, shows an instrument in which 44 of the 49 items had a factor loading greater than 0.30. The conventional cut-off value of 0.30 was chosen for the factor loadings (Stevens, 1992). This pattern was also found to be very similar for the preferred version. On completion of the factor analysis with the 49 item seven scale instrument, 5 items were deleted. The items that were deleted were item 5 in the Personalisation scale, item 34 in the Individualisation scale and item 47 in the Innovation scale, all of which had a factor loading of less than 0.30; item 19 in the Task Orientation scale, and item 29 in the Individualisation scale were deleted because they loaded on more than one factor. The factor loading values of the remaining 44 items in the instrument confirm the seven-factor structure of the CUCEI.

4.2.1.2 *Internal Consistency*

Table 4.2 reports two reliability and validity statistics for the seven scale, 49-item version of the CUCEI used in the present study. The table also illustrates the differences in the internal consistency before and after factor analysis. A sample size of 504 students in 26 classes participated in this study. In accordance with all previous research, reliabilities and validity are reported for two units of analysis, the individual student and the class mean. The internal consistency of the seven scales in the CUCEI, which is the measure of the extent to which items in the same scale measure the same dimension is reported Table 4.2.

Table 4.1

Factor Loadings for Items in the 49-Item Actual Personalised Form of the CUCEI

		Factor Loadings						
Scale	Item	F1	F2	F3	F4	F5	F6	F7
Personalisation	1			0.68				
	2			0.66				
	3			0.71				
	4			0.65				
	5			-				
	6			0.64				
	7			0.55				
Student Cohesiveness	8					0.60		
	9					0.61		
	10					0.67		
	11					0.69		
	12					0.49		
	13					0.66		
	14					0.48		
Task Orientation	15				0.43			
	16				0.59			
	17				0.70			
	18				0.62			
	19			0.37	0.44			
	20				0.35			
	21				0.52			
Cooperation	22		0.69					
	23		0.67					
	24		0.80					
	25		0.67					
	26		0.78					
	27		0.81					
	28		0.74					
Individualisation	29	0.34						
	30						0.56	
	31						0.71	
	32						0.81	
	33						0.72	
	34						-	
	35						0.52	
Equity	36	0.73						
	37	0.76						
	38	0.80						
	39	0.79						
	40	0.77						
	41	0.66						
	42	0.75						
Innovation	43							0.35
	44							0.35
	45							0.80
	46							0.75
	47							-
	48							0.65
	49							0.39

Factor loadings less than 0.30 not shown

Table 4.2

Internal Consistency Reliability (Cronbach Alpha Coefficient) for Two Units of Analysis for the College and Universities Classroom Environment Inventory (CUCEI) before and after the Removal of the 5 Items

CUCEI Scales	Unit of Analysis	Reliability							
		Students				**Instructors**			
		Before Removal		*After Removal*		*Before Removal*		*After Removal*	
		Actual	Preferred	Actual	Preferred	Actual	Preferred	Actual	Preferred
Personalisation	Individual	0.81	0.69	0.87	0.84	0.82	0.72	0.79	0.72
	Class	0.93	0.73	0.95	0.87				
Student Cohesiveness	Individual	0.82	0.83	0.82	0.83	0.77	0.75	0.77	0.75
	Class	0.96	0.88	0.96	0.88				
Task Orientation	Individual	0.79	0.81	0.77	0.79	0.69	0.70	0.64	0.74
	Class	0.92	0.92	0.92	0.92				
Cooperation	Individual	0.92	0.93	0.92	0.93	0.84	0.87	0.84	0.87
	Class	0.96	0.94	0.96	0.94				
Individualisation	Individual	0.73	0.74	0.82	0.80	0.85	0.92	0.85	0.90
	Class	0.86	0.89	0.93	0.94				
Equity	Individual	0.93	0.94	0.93	0.94	0.90	0.91	0.90	0.91
	Class	0.97	0.98	0.97	0.98				
Innovation	Individual	0.69	0.67	0.73	0.76	0.66	0.81	0.72	0.93
	Class	0.86	0.88	0.84	0.93				

Table 4.2 shows the alpha reliability values for the seven different scales in the CUCEI, for both the actual and preferred versions. The Cronbach alpha reliability figures for the actual version, before the deletion of the five items identified earlier, when the individual student was used as the unit of analysis for the different scales range from 0.69 to 0.93, whereas in the preferred version the figures range from 0.67 to 0.94. After the deletion of the five items, the Cronbach alpha reliability ranged from 0.73 to 0.93 and 0.76 to 0.94 for the actual and preferred versions respectively. These values, with the individual student as the unit of analysis, are generally higher than those reported for the original CUCEI where the alpha reliability ranged from 0.75 to 0.90 for the actual version and 0.63 to 0.82 for the preferred form (Fraser, Treagust, Williamson, & Tobin, 1986). As expected, when class means were used as the unit of analysis, all alpha reliability values were higher, ranging from 0.86 to 0.97 for the actual version and 0.73 to 0.98 for the preferred form prior to the deletion of the respective items and from 0.84 to 0.97 for the actual version and 0.87 to 0.98 for the preferred version after the removal of the respective five items. All figures well exceed the threshold of 0.60 set by Nunnally (1967) as being acceptable reliability for research purposes. After the removal of the five items from the instrument, the internal consistency of the instrument was generally seen to improve as can be observed in Table 4.2. For all further analysis, the remaining 44 items were used.

The same trend of higher alpha reliability figures for instructor versions compared with the original CUCEI were also apparent. The alpha reliability values using the individual as the unit of analysis for the present form of the CUCEI prior to item deletion ranged from 0.66 to 0.90 for the actual version and 0.70 to 0.92 for the preferred version. After item deletion the Cronbach alpha coefficients ranged from 0.64 to 0.90 for the actual version and from 0.72 to 0.93 for the preferred version. The values for the original form of the CUCEI ranged from 0.53 to 0.83 and 0.55 to 0.82 for the actual and preferred forms respectively (Fraser, Treagust, Williamson, & Tobin, 1986).

4.2.1.3 *Discriminant Validity*

Table 4.3 reports data about the discriminant validity (using the mean correlation of a scale with the other six scales as a convenient index) for each of the four forms of the CUCEI using both the individual student and the class as the unit of analysis. The discriminant validity is described as the extent to which a scale measures a dimension not covered by the other scales in the instrument. These values are generally small enough, from 0.15 to 0.38 for the actual version and from 0.25 to 0.47 for the preferred form, to suggest that each of the CUCEI scales has adequate discriminant validity for use in its actual and preferred forms, with both students and instructors. From the values, the CUCEI appears to measure distinct although somewhat overlapping aspects of classroom environment, but maintaining distinctions between each scale in each of the seven dimensions in the instrument.

4.2.1.4 *Capability of differentiating between classrooms*

A desirable feature of any instrument used in learning environment research is the capability to differentiate between the perceptions of students in different classrooms. This means that students within the same class should perceive their environment relatively similarly while the mean perception measure should vary from class to class. The characteristics of differentiating between perceptions in different classes was investigated for each scale using a one-way ANOVA with class membership as the main effect and using the individual as the unit of analysis. Table 4.3 above indicates that each CUCEI scale differentiated significantly ($p<0.001$) between classrooms. The eta^2 statistic, representing the proportion of variance attributable to class membership, ranged from 0.09 to 0.28 for the CUCEI scales. Table 4.3 below reports all values after the deletion of the five items following factor analysis.

Table 4.3

Discriminant Validity (Mean Correlation with Other Scales) and the Ability to Differentiate between Classrooms (ANOVA) for Two Units of Analysis for the College and Universities Classroom Environment Inventory (CUCEI)

Scales	Unit of Analysis	Mean Correlation with other scales				ANOVA eta^2
		Student		Instructor		
		Actual	Preferred	Actual	Preferred	
Personalisation	Individual	0.34	0.45	0.30	0.44	0.23**
	Class	0.30	0.30			
Student Cohesiveness	Individual	0.20	0.47	0.28	0.28	0.28**
	Class	0.38	0.43			
Task Orientation	Individual	0.27	0.44	0.33	0.21	0.27**
	Class	0.33	0.44			
Cooperation	Individual	0.25	0.45	0.29	0.40	0.11*
	Class	0.29	0.38			
Individualisation	Individual	0.15	0.25	0.35	0.41	0.22**
	Class	0.34	0.35			
Equity	Individual	0.30	0.42	0.18	0.19	0.09*
	Class	0.38	0.45			
Innovation	Individual	0.22	0.43	0.18	0.42	0.13**
	Class	0.35	0.39			

** $p < 0.001$ * $p < 0.01$ *The sample consisted of 504 students in 26 classes and 24 instructors.*

4.2.2 *Attitudinal Scales*

For consistency, the same type of analysis was performed for the three scales in the attitudinal measure of this study and the results are depicted in Table 4.4.

4.2.2.1 *Internal Consistency*

The Cronbach alpha reliability values ranged from 0.62 to 0.77 for the actual form using the student as the unit of analysis. The alpha values were higher when the class was used as the unit of analysis, and ranged from 0.73 to 0.88.

4.2.2.2 *Discriminant Validity*

The discriminant validity (using the mean correlation of a scale with other two scales as a convenient index) ranged from 0.10 to 0.34 when the individual student was used as the unit of analysis and from 0.31 to 0.52 when the class was the unit of analysis. These values suggest that the attitudinal scales have adequate discriminant validity for use in its actual form. The values also suggest that there is greater overlap in these three scales than in the scales in the CUCEI.

4.2.2.3 *Capability of Differentiating between Classroom*

The one-way ANOVA with class membership as the main effect and using the individual as the unit of analysis, also indicated the sensitivity of the these scales in differentiating between the perceptions of students in different classrooms. Table 4.4 below summarises the results for all the scales.

Table 4.4
Internal Consistency Reliability (Cronbach Alpha Coefficient) and the Ability to Differentiate Between Classrooms (ANOVA) for Two Units of Analysis in the Attitudinal Scales for Students

Scales	Unit of Analysis	Reliability	Mean Correlation with other scales	ANOVA eta^2
Satisfaction	Individual	0.76	0.10	0.12**
	Class	0.88	0.31	
Difficulty	Individual	0.77	0.30	0.13**
	Class	0.87	0.51	
Speed	Individual	0.62	0.34	0.09*
	Class	0.73	0.52	

** $p<0.001$, * $p<0.01$ *The sample consisted of 504 students in 26 classes and 24 instructors.*

This differentiation between classes was confirmed with the eta^2 statistic, which is the estimate of variance in CUCEI scores attributable to class membership. Figures ranged from 0.09 for the Speed scale to 0.13 for the Difficulty scale.

4.3 Summary

From the evaluation of the validation data in this research, it seems safe to conclude that the modified and personalised form of the CUCEI is a reliable and valid instrument in measuring students' and instructors' actual and preferred perceptions of their classroom. Furthermore, the scales chosen to evaluate the additional aspects in this study also showed acceptable reliability and validity.

The next Chapter reports the results of the application of the modified and personalised version of the CUCEI to students' and instructors' perceptions at both the senior secondary and post secondary levels of study.

CHAPTER 5

RESULTS OF APPLICATION OF THE CUCEI

5.1 Introduction

The validation of the CUCEI was reported in the previous chapter. This chapter looks at the results from the application of the instrument to students' and instructors' perceptions at both the senior secondary and post secondary levels of studies. This chapter is structured into five sections which examine results related to research objectives two to five that have been defined in Chapter 1. Finally, qualitative data were used to complement and explain differences in findings observed in the quantitative aspects of the research.

Previous research, reviewed in this thesis in Chapter 2, has shown differences in students' perceptions of their actual and preferred classroom environments; students generally preferring a more positive learning environment (e.g., Henderson, Fisher, & Fraser, 1995). On the other hand, instructors usually gauged their environment more favourably than students (e.g., Fraser, 1991; Templeton & Jensen, 1993). Males and females also have been shown to perceive their environment differently (e.g., Burkam, Lee, & Smerdon, 1997; Ferguson & Fraser, 1997; Riah & Fraser, 1999; Rickards, Fisher, & Fraser, 1997; Suarez, Pias, Membiela, & Dupia, 1998; Waldrip & Fisher, 1999; Wong & Fraser, 1994).

5.2 Research Objective 2 - Use of the CUCEI to investigate students' perceptions

5.2.1 *Students' Perceptions of their Classroom*

The values of the means of the scales in the student version of the CUCEI shown in Table 5.1 range from 2.45 to 4.26 for the actual version and from 3.28 to 4.23 for the preferred version. All mean and standard deviation values reported in this research refer to item means in each respective scale. In the actual version, with the exception of the Individualisation scale which had the lowest mean value of 2.45, all other scales had mean values of greater than 3.0 out of a possible maximum mean score of 5.0.

Table 5.1
Means and Standard Deviations for the Actual and Preferred Forms of the CUCEI for the Total Student Sample

Scale	Mean		Difference	Standard Deviation		*t*-Test
	Actual (A)	Preferred (P)	(P-A)	Actual	Preferred	Values
Personalisation	3.82	4.16	0.34	0.78	0.71	6.55*
Student Cohesiveness	3.85	3.87	0.02	0.76	0.80	0.41
Task Orientation	3.73	3.92	0.19	0.69	0.76	3.93*
Cooperation	3.61	3.82	0.21	0.90	0.87	3.51*
Individualisation	2.45	3.28	0.83	0.87	0.84	13.15*
Equity	4.26	4.23	- 0.03	0.77	0.86	0.38
Innovation	3.10	3.46	0.36	0.72	0.73	7.28*

* $p < 0.05$ n=504 pairs

Significant differences between actual and preferred student perceptions in this chapter were explored using a paired *t*-test for each scale of the CUCEI. However, significant differences between two different groups (e.g, males vs females, mature students vs first time students) were explored using the differences of two means (an independent-samples *t*-test) for each scale of the CUCEI. Table 5.1 indicates that for five of the seven scale of the CUCEI, there were statistically significant differences in students' perceptions in their actual and preferred forms. Whilst the magnitude of

difference is not large for four of the statistically significant scales, the direction of differences is consistent in that students preferred a more positive learning environment than that which they perceived to be present. This finding is profiled in Figure 5.1 This replicates findings from past research (Fisher & Fraser, 1983; Fraser, 1991; Suarez, Pias, Membiela, & Dupia, 1998; Templeton & Jensen, 1993). Figure 5.1 shows differences which were statistically significant. Scales which were found not to be statistically significant are depicted in Figure 5.1 as the same point, the average of the actual and preferred forms.

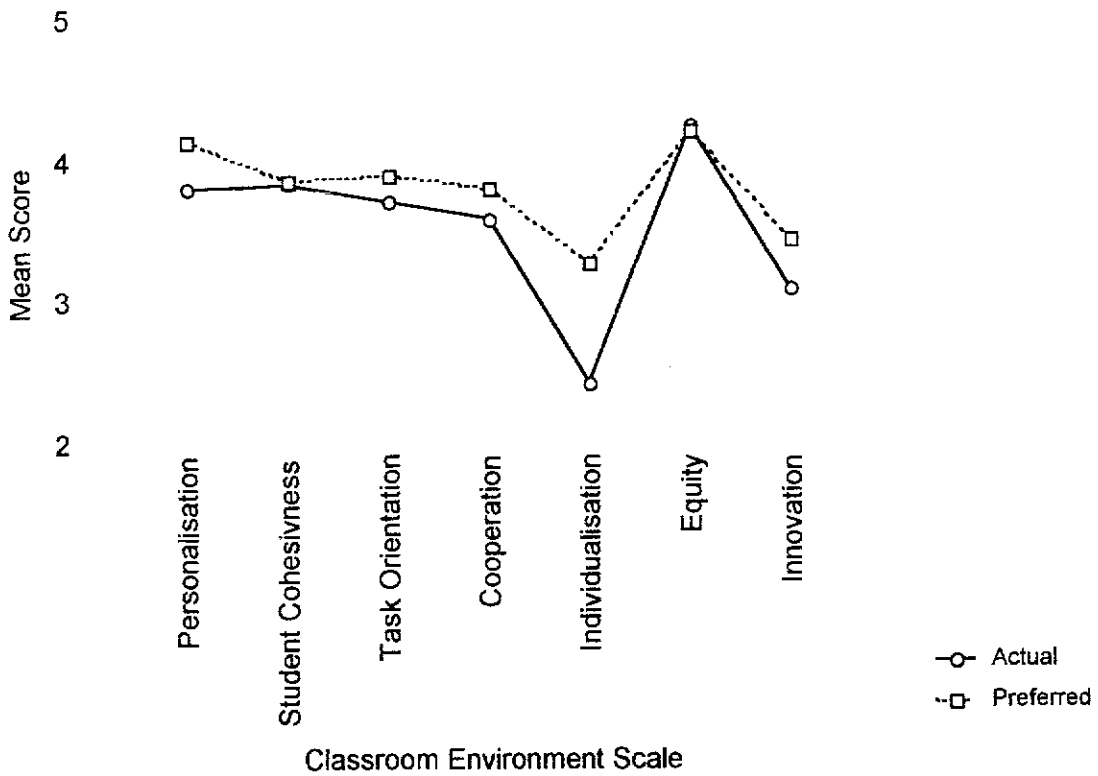

Figure 5.1. Scale mean profiles for student Actual and Preferred forms of the CUCEI.

Note: Statistically non-significant differences are represented on the respective figures as the average of the means (actual & preferred) and appear as the same point on the figure.

Student Cohesiveness and Equity are plotted with a single point in Figure 5.1 to indicate that there was no statistically significant difference in the perceptions of students in the actual and preferred forms. Further, this finding suggests that most

students were generally comfortable with the friendliness of fellow classmates. These sentiments were clearly expressed by students:

> *We know each other well.*
>
> *We come from the same school.*
>
> *I come from another school in another state, and I find the students in my classroom friendly.*

This same sentiment was echoed by the classroom instructors when they enunciated the following:

> *Student cohesiveness in the class is high because most students know each other before commencing at the college because they come from the region, the local high schools.*
>
> *They know each other. Most come from the same high school.*
>
> *Everyone is friendly in class. I can't take credit for this.*

Qualitative data collected from class interviews also complement the quantitative data for the Equity scale. Typical statements enunciated by students in the interview were:

> *Our work is pretty much judged equally.*
>
> *Everyone is very much treated the same.*
>
> *No, I have not seen any discrepancies.*

Again the comments of the instructors were similar:

> *I treat the students the same*
>
> *I set up a marking scheme which I follow for all, and I am available to all students*

The smallest statistically significant difference was noted in two scales, Task Orientation and Cooperation scales. This suggests that students were more satisfied with the classroom environment with respect to these scales. The greatest statistical significant difference between the actual and preferred forms was in the Individualisation scale. This suggest students prefer to have a greater role in decision making, and prefer their instructors to take more account of the varying differences in student ability and interests in the respective science classes.

5.2.2 Comparison of Students' Perceptions at Senior and Post Secondary Level

Generally, students prefer a more positive environment in their classroom, as seen in the results detailed in section 5.2.1. This trend is apparent at both levels, as depicted by the data in Tables 5.2 and 5.3.

Table 5.2
Means and Standard Deviations for the Actual and Preferred Forms of the CUCEI for Students in their Senior Secondary level

Scale	Mean		Difference	Standard Deviation		*t*-test
	Actual (A)	Preferred (P)	(P-A)	Actual	Preferred	Values
Personalisation	3.93	4.15	0.22	0.74	0.76	3.55**
Student Cohesiveness	4.06	3.89	- 0.17	0.66	0.80	2.71*
Task Orientation	3.62	3.76	0.14	0.73	0.80	2.31*
Cooperation	3.71	3.78	0.07	0.86	0.86	0.94
Individualisation	2.62	3.88	1.26	0.90	0.82	9.87**
Equity	4.19	4.07	- 0.12	0.80	0.91	1.70
Innovation	3.01	3.45	0.44	0.71	0.74	7.62**

** $p < 0.001$ * $p < 0.05$ n=374 pairs

At the senior secondary level there were statistically significant differences in five of the seven scales, whereas at the post secondary level differences in all seven scales were found to be statistically significant. However, students at the senior secondary level appear to have greater satisfaction in their actual classroom environment in four of the seven scales (see Figures 5.2 and 5.3). These were

Personalisation, Student Cohesiveness, Cooperation and Individualisation. The largest significant difference for both levels was with respect to the Individualisation scale. This result suggests that students preferred to have a greater decision making role in their classes, compared with what they perceive they have at present. Students at the post secondary level showed a greater preference in this scale as depicted by the greater difference, 2.13 for post secondary compared with 1.26 for senior secondary.

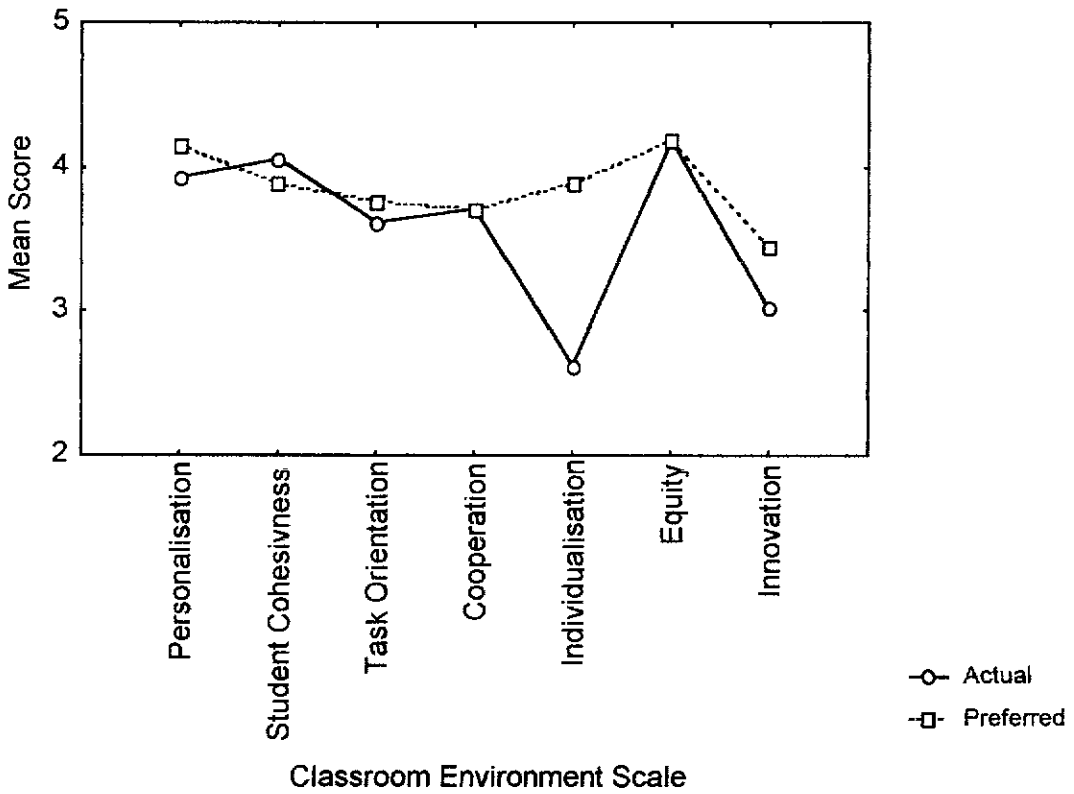

Figure 5.2. Scale mean profile for Actual and Preferred forms of the CUCEI for students in their senior secondary level of study.

Note: Statistically non significant differences are represented as the average of the means (actual & preferred) and appear as the same point on the figure.

The spread in standard deviation was generally about the same at both levels though slightly higher for the preferred version for the senior secondary level. In comparison to the post secondary level (see Table 5.3), students were generally

more in agreement as to their preferred classroom environment as the standard deviations in the preferred versions were slightly lower.

Table 5.3
Means and Standard Deviations for the Actual and Preferred Forms of the CUCEI for Students in their Post Secondary Level

Scales	Mean		Difference	Standard Deviation		*t*-test
	Actual (A)	Preferred (P)	(P-A)	Actual	Preferred	Values
Personalisation	3.56	4.19	0.63	0.78	0.59	7.09*
Student Cohesiveness	3.36	3.82	0.46	0.76	0.79	4.85*
Task Orientation	3.94	4.28	0.34	0.52	0.53	5.39*
Cooperation	3.38	3.93	0.55	0.95	0.89	4.45*
Individualisation	2.10	4.23	2.13	0.71	0.53	29.03*
Equity	4.42	4.61	0.19	0.64	0.58	12.53*
Innovation	3.29	3.48	0.19	0.69	0.71	2.00*

*$p < 0.05$ n=130 pairs

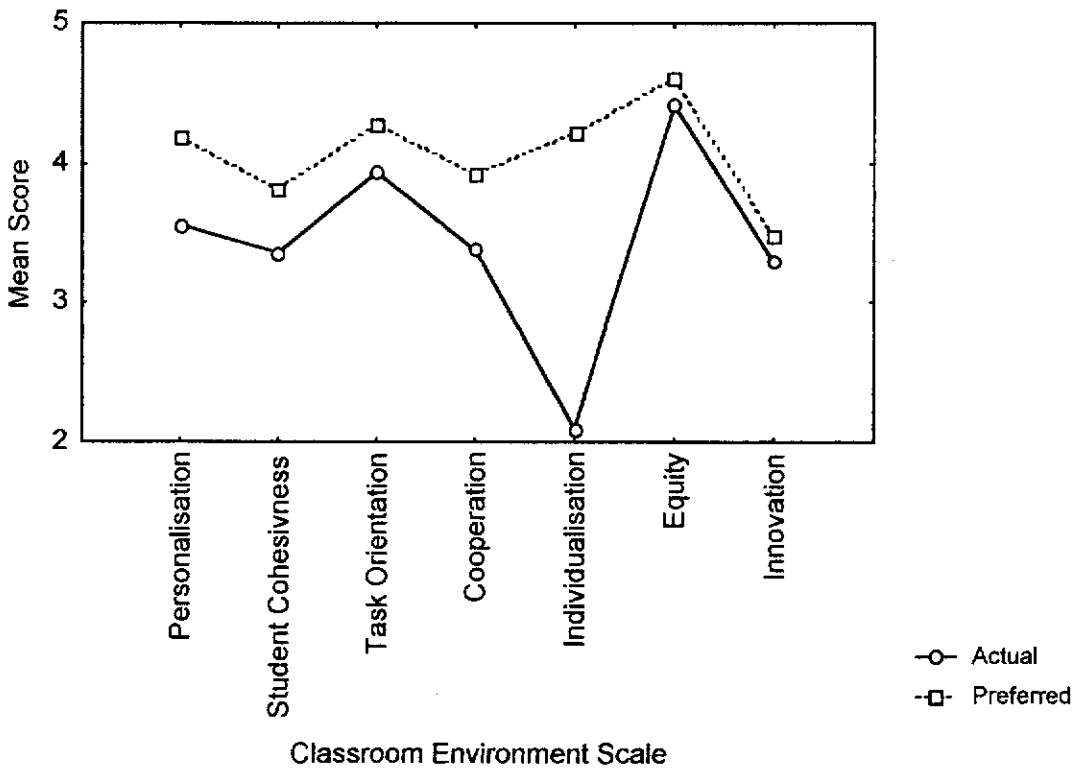

Figure 5.3. Scale mean profiles for Actual and Preferred forms of the CUCEI for students in their post secondary level of study.

The classroom environments at the two levels were compared in two ways. Firstly, with respect to significant differences in student perceptions between both levels using a paired t-test for each scale of the CUCEI, and secondly, explored with effect sizes (see Table 5.4). Effect sizes were calculated using Cohen's d formula (1977) where the difference in the two group means, for each scale, is divided by the pooled standard deviation. Interpretations on the magnitude of effect size are based on Cohen's (1977) operational definitions of 0.20, 0.50 and 0.80 as being small, medium and large effect sizes, respectively.

Table 5.4

Comparison of Mean, Differences and Effect Sizes for Students in their Senior Secondary and Post Secondary level for the Actual and Preferred Forms of the CUCEI

Scale	Form	Mean		Difference	t-test	Effect
		Post (P)	Senior (S)	(S-P)	Values	Size
Personalisation	Actual	3.56	3.98	0.42	4.54**	- 0.55
	Preferred	4.19	4.20	0.01	0.06-	0.02
Student Cohesiveness	Actual	3.36	3.98	0.62	6.63**	- 0.87
	Preferred	3.82	3.92	0.10	1.00-	0.13
Task Orientation	Actual	3.94	3.77	- 0.17	2.50*	0.27
	Preferred	4.28	3.79	- 0.49	5.68**	0.72
Cooperation	Actual	3.38	3.85	0.47	3.86**	- 0.52
	Preferred	3.93	3.72	- 0.21	1.95	0.24
Individualisation	Actual	2.10	2.50	0.40	3.96**	- 0.49
	Preferred	4.23	3.42	0.81	3.87**	0.47
Equity	Actual	4.42	4.31	- 0.11	1.30	0.17
	Preferred	4.61	4.03	- 0.58	5.88**	0.76
Innovation	Actual	3.29	2.98	- 0.31	3.50*	0.44
	Preferred	3.48	3.51	0.03	0.37-	0.04

** $p < 0.01$ * $p < 0.05$ n = 130 pairs

Note:

1. Effect sizes were calculated using Cohen's d formula (1977) where the difference in the two means (P-S), for each scale, is divided by the pooled standard deviation.

When a comparison of environments was made between the two levels, via the comparison profiles in Figure 5.4 and the data in Table 5.4, there were statistically significant differences in the students' perceptions. Post secondary students generally had a less favourable perception of their classroom environment than did senior secondary students. Figure 5.4 reveals that students at the higher level gauge their actual classroom more favourably in two areas, namely, Task Orientation and Innovation. These findings, that students moving from a lower level to the higher level of studies generally had a less favourable perception of their classroom environment are consistent with findings at the primary/secondary level transition (e.g., Atkinson & Atkinson, 1977; Ferguson & Fraser, 1996; Midgley, Eccles, & Feldlaufer, 1991) as well as at the secondary/tertiary level transition (e.g., Booth, 1997; Brendt & Hawkins, 1985).

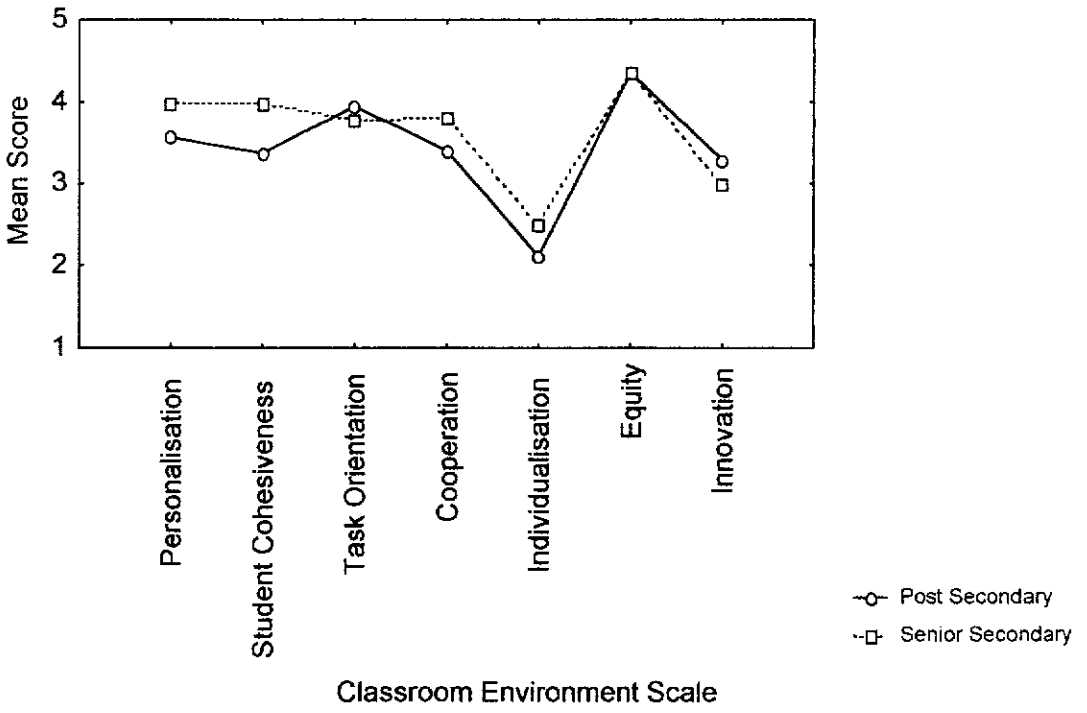

Figure 5.4. Comparison of Actual classroom environment scales for students at the post secondary and senior secondary level of studies.

Note: Statistically non significant differences are represented as the average of the means (Post & Senior) and appear as the same point on the figure.

Students at the post secondary level perceived their instructors as being more innovative in their approach to teaching. This finding lends support to the 'guided' approach that is being utilised by some of the instructors at the local community college in Terrace, British Columbia. Further support for the innovative approach to teaching is illustrated by the results in section 5.5 (pages 132-139). The higher perception in the scale measuring Task Orientation seems to suggest that the innovative teaching approaches used by the instructors at the local community college, coupled with well defined classroom expectations, are better appreciated by students at the post secondary level. Further support for this favourable perception comes from the classroom observations by the researcher where the lessons were generally well designed and the instructors' expectations clearly explained to the students (see section 5.5, pages 132-139). This finding is different from that reported by Killen (1994) where students were generally dissatisfied with inappropriate assessment procedures, and expectations in classwork were not clear to the students.

The pattern for student cohesiveness being greater at the lower level of studies was also found in previous research (Fraser, Treagust, Williamson, & Tobin, 1987; Midgley, Eccles, & Feldlaufer, 1991). However, the lower student cohesiveness perceived by the students at the post secondary level suggests that students may either not know each other prior to coming to Northwest Community College or that students tend to be more individualistic at higher levels. This result seems to be at odds to what was expected as the local college intake of students is usually from the local high schools in the region and class sizes at the college are small and do not exceed 36 students. It would seem safe to suggest the latter reason, that is the individualistic approach to studies to be the more appropriate explanation for the reported low mean score in this scale. This reasoning is further supported by observations made by all three instructors who took part in this research when they enunciated the following;

Most students come from this region and have grown up here.

Student cohesiveness in the class is high because most students know each other before commencing at the college because they come from the region, the local high schools.

Everyone is friendly in the class. As for student friendliness in groups, in this class there are not many opportunities.

Consistent with the findings of Midgley, Eccles, and Feldlaufer (1991), Power and Cotterell (1981) and Trebilco, Atkinson, and Atkinson (1977), students experienced less favourable interpersonal relationships with the instructors after transition. This is seen in the lower mean values in the Personalisation scale at the higher level of study, 3.56 compared with 3.98. Further supporting this less favourable interpersonal experience are the comments from post secondary students:

I found the caring aspect in high school where the teachers' job was to make you learn (was missing) as opposed to just delivery of the lesson at the college. I find it different.

Teachers here [post secondary] I find are bodies of knowledge that share bits as presented by the curriculum whereas in the high school they're people [instructors] that help you work and learn as opposed to being taught facts and processes.

The lowest mean scores were recorded for both levels in the Individualisation scale, with the post secondary students perceiving the class less favourably than did the senior secondary students. The difference in perception at the post secondary level was over two standard deviations compared with slightly over one standard deviation difference for the senior secondary level (see Table 5.2 and 5.3). This suggests that students do perceive that there is less choice at the higher level of studies. Similar findings were also reported by researchers in their study of transition environments from the elementary to junior high school (Midgley, Eccles, & Feldlaufer, 1991). Both levels clearly indicated that the students were dissatisfied in this area. This dissatisfaction as measured by the Individualisation scale is clearly demonstrated by the views expressed by the students. Students reported the following;

To be frank it is overwhelming (workloads). I was swamped when I first got here. I did not believe how much work they (instructors) expected. In high school they don't have this stuff. I spend 18 hours on a report. It is unreal.

The view expressed here seems to suggest that instructors at the higher level do not take into account the differing abilities of their students. This view lends further support to the findings of Killen (1994) where students reported too many demands on their time and said that instructors had unrealistically high expectations of their students. One other possible explanation for the lower mean values in the Individualisation scale at the post secondary level is that students could possibly be relying on their instructors for what they should know before they move on to the second year and as such do not want too much decision making authority at this level. Students could pursue their second year at Northwest or transfer to one of the numerous institutions in British Columbia. This reasoning seems to be supported by the comments of the Biology and Physics instructors:

We have no control. We have to cover X amount of material before they move on to their second year.

If they work on their own pace they would have nothing done. It is a university lecture and there is a certain amount of material to cover and you cover it.

The reasoning behind this comment could be that all university courses are articulated (formal agreements on syllabus) with the individual universities in British Columbia regarding acceptance of credits from one another, and not completing the required amount of material would place the students transferring to these institutions at a disadvantage. It would be safe to suggest that instructors in the second year of post secondary studies either at Northwest or the numerous institutions in British Columbia would expect that the agreements have been honoured with respect to the content coverage in the respective science courses.

Examination of the effect sizes (see Table 5.4) in the actual version of the CUCEI indicates the effect sizes in the 'small' category for the Task Orientation,

Individualisation and Innovation scales, 'medium' category for the Personalisation and Cooperation scales and 'large' category for the scale of Student Cohesiveness. However, the Equity scale reported an effect size of less than the minimum of 0.20. The analysis indicates that there is a negative effect on post secondary students perceptions on those factors measured by Personalisation, Student Cohesiveness, Cooperation and Individualisation but positive on those factors measured by the Task Orientation and Innovation scales.

When the preferred environments were compared, the data as shown in Figure 5.5 and in Table 5.4 revealed statistically significant differences in student perceptions of the levels of Task Orientation, Individualisation and Equity in their classes.

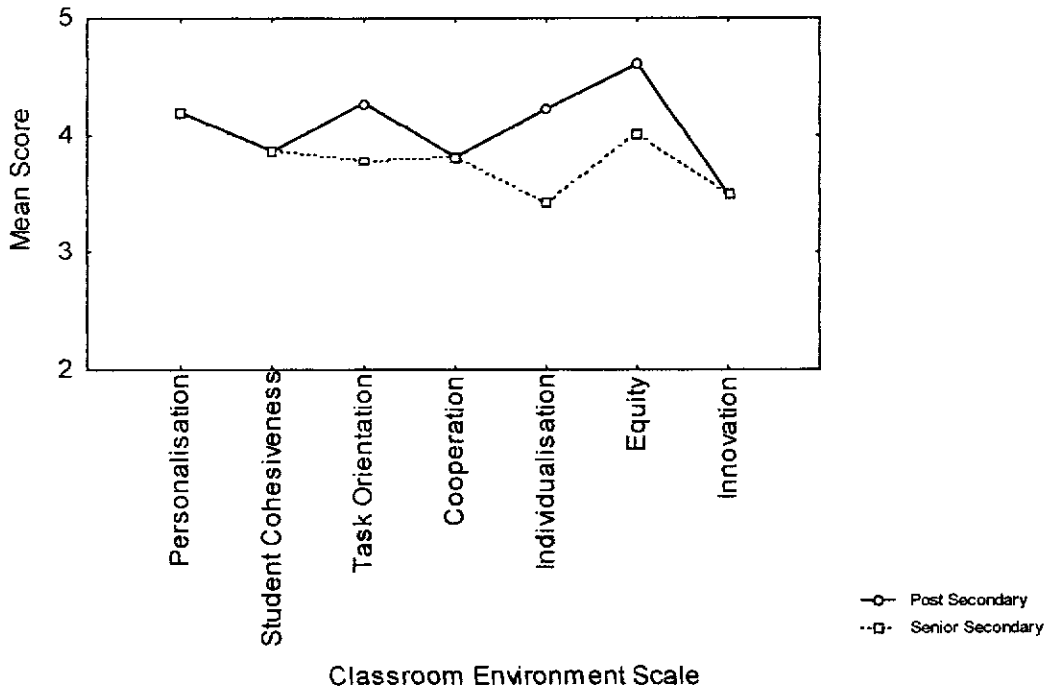

Figure 5.5. Comparison of Preferred classroom environment scales for students at the post and senior secondary level of studies.

Note: Statistically non significant differences are represented on the respective figures as the average of the means (Post & Senior) and appear as the same point on the figure.

The preferred results for the senior secondary level indicate that students would generally prefer a greater decision making role in their classrooms, as measured by

the Individualisation scale, though much less than that preferred by the post secondary students. No statistically significant difference was observed in students' perceptions between post secondary and senior secondary levels in the Equity scale in the actual environment. This is supported by comments made by students (See page 101)

However, post secondary students seem to indicate that they would prefer some changes in this area as reported by the higher mean value in their preferred environment.

Similarly, when the effect sizes in the preferred versions were examined, three of the seven scales showed effect sizes which were negligible, at 0.13 or smaller. These scales were Personalisation, Student Cohesiveness and Innovation. Large effect sizes were evident in the Task Orientation and Equity scales while medium effect sizes were evident in the Cooperation and Individualisation scales. The analysis also indicates that there is a positive effect on post secondary students' perceptions on those factors measured by Task Orientation, Cooperation, Individualisation, and Equity.

Effect size calculations confirm the findings reported in the statistical analysis, where post secondary students had less favourable perceptions of their classroom environment than did senior secondary students.

5.3 Research Objective 3 - Students' Gender and Age Influences

5.3.1 *Differences in Perception based on the Gender of Students*

All female students perceived differences in all the scales between the actual and preferred environments (see Table 5.5). However, statistically significant differences were observed in only five of the seven scales in male students' perceptions (see Table 5.6), these scales being Personalisation, Student Cohesiveness, Task

Orientation, Cooperation and Individualisation. However, both male and female students appeared to have a varied perception of the degree of cooperation in their actual classroom. This is indicated by the relatively large standard deviations, 0.92 and 1.00 for female and male students, respectively.

Table 5.5
Means and Standard Deviations for the Actual and Preferred Forms of the CUCEI for all Female Students

Scale	Mean		Difference	Standard Deviation		*t*-test
	Actual (A)	Preferred (P)	(P-A)	Actual	Preferred	Values
Personalisation	3.64	4.26	+0.62	0.82	0.55	5.39*
Student Cohesiveness	3.38	3.78	+0.40	0.76	0.81	3.03*
Task Orientation	3.93	4.34	+0.41	0.52	0.53	4.09*
Cooperation	3.44	4.08	+0.64	0.92	0.68	4.32*
Individualisation	2.04	2.94	+0.90	0.66	0.82	6.86*
Equity	4.34	4.67	+0.33	0.67	0.49	3.13*
Innovation	3.23	3.56	+0.33	0.60	0.74	2.68*

* $p<0.05$ n=99 pairs

Table 5.6
Means and Standard Deviations for the Actual and Preferred Forms of the CUCEI for Male Students (Canadian Sample Only)

Scale	Mean		Difference	Standard Deviation		*t*-test
	Actual (A)	Preferred (P)	(P-A)	Actual	Preferred	Values
Personalisation	3.44	4.09	+0.65	0.75	0.63	5.81*
Student Cohesiveness	3.33	3.84	+0.51	0.75	0.76	3.68*
Task Orientation	3.94	4.23	+0.29	0.55	0.54	3.04*
Cooperation	3.37	3.76	+0.39	1.00	1.02	2.07*
Individualisation	2.14	3.04	+0.90	0.74	0.87	6.07*
Equity	4.45	4.58	+0.13	0.63	0.63	1.08
Innovation	3.37	3.40	+0.03	0.77	0.69	0.32

* $p < 0.05$ n=106 pairs

Note: Statistically non significant differences are represented on the respective Figures as the average of the means (actual & preferred) and appear as the same point on the figure.

With the exception of the Cooperation scale for male students which has a standard deviation of 1.02, both male and female students were generally in agreement about what their preferred classroom should be like, though the mean scores for the female students were very slightly higher than those of the male students in all scales except for Individualisation and Student Cohesiveness. Female students appeared to want less of a decision making role in the classroom. Female students also indicated a greater preference for cooperation than the male students in their classrooms. This is similar to findings in other research (Johnson & Johnson, 1991; Owens and Straton, 1980; Rennie & Harding, 1995).

Table 5.7
Comparison of Means and Differences for the Actual and Preferred Forms of the CUCEI for Male and Female students

Scale	Form	Mean		Difference	t-test
		Male (M)	Female (F)	(M-F)	Values
Personalisation	Actual	3.43	3.64	- 0.21	1.50
	Preferred	4.10	4.26	- 0.16	1.66
Student Cohesiveness	Actual	3.33	3.38	- 0.05	0.10
	Preferred	3.90	3.78	0.12	0.94
Task Orientation	Actual	3.94	3.93	0.01	0.59
	Preferred	4.25	4.34	- 0.09	0.97
Cooperation	Actual	3.37	3.44	- 0.07	0.05
	Preferred	3.77	4.08	- 0.31	2.22*
Individualisation	Actual	2.14	2.04	0.10	0.51
	Preferred	3.10	2.94	0.16	0.74
Equity	Actual	4.45	4.34	0.11	1.08
	Preferred	4.59	4.67	- 0.08	0.70
Innovation	Actual	3.37	3.23	0.14	0.90
	Preferred	3.41	3.56	- 0.15	1.20

* $p < 0.05$ n = 99 groups

When a statistical comparison of perceptions was made using an independent-samples *t*-test for each scale in the CUCEI within the actual and preferred classroom

environments, both males and females perceived their environment almost identically (see Table 5.7).

This similarity in perceptions replicates findings in other studies, that male and female students' perceptions moved closer together as they moved into higher level studies (Ferguson & Fraser, 1996; Fraser 1989; Johnson, 1991). One other possible reason for the closeness of the perceptions could be attributed to the same students from the high schools going to the local community college. This observation could therefore lend further support to the observations of the instructors at the local community college who have found students in their cliques from their local high schools and take college life as an extension of their high schools. However, the findings here contrast with findings that show that there are significant differences in the perceptions of male and female students (e.g. Burkam, Lee, & Smerdon, 1997; Ferguson & Fraser, 1996; Henderson, Fisher, & Fraser, 1998; Riah & Fraser, 1999; Rickards, Fisher, & Fraser, 1997; Suarez, Pias, Membiela, & Dupia, 1998; Waldrip & Fisher, 1999). The only statistically significant difference was observed in the preferred version of the Cooperation scale. Female students preferred more cooperation in their classrooms than did the male students and this finding is consistent with those of previous research studies where there was a preference of female students for greater cooperation in the classroom (e.g., Owens & Straton, 1980; Rennie & Harding, 1995).

An interesting feature of the results in Table 5.7 is that male and female students were in agreement that there was hardly any difference in the way they were treated by their instructors, as measured by the Equity scale. This was clearly echoed by the students during the interviews (see page 101).

5.3.2 *Mature Students*

Mature students are defined by Northwest Community College as students who have started to attend tertiary studies at the age of 19 and above. Studies have shown that

older students perceive their classroom environment differently from younger students (Fraser, Treagust, Williamson, & Tobin, 1987). The results as profiled in Table 5.8 and Figure 5.6 show that older students in the classes of this study also preferred a more positive environment.

Table 5.8
Means and Differences for the Actual and Preferred Forms of the CUCEI for Mature Age Students at the Post Secondary Level

Scale	Mean		Difference	Standard Deviation		*t*-test
	Actual (A)	Preferred (P)	(P-A)	Actual	Preferred	Values
Personalisation	3.78	3.98	0.20	0.47	0.54	2.17*
Student Cohesiveness	3.40	3.56	0.16	0.96	0.77	0.75
Task Orientation	3.93	4.22	0.29	0.52	0.49	2.93*
Cooperation	3.32	3.63	0.31	0.94	0.99	1.58
Individualisation	2.15	2.80	0.65	0.58	0.68	4.83*
Equity	4.51	4.40	- 0.11	0.54	0.66	0.58
Innovation	3.13	3.44	0.31	0.58	0.68	2.07*

* $p < 0.05$ n = 45 pairs

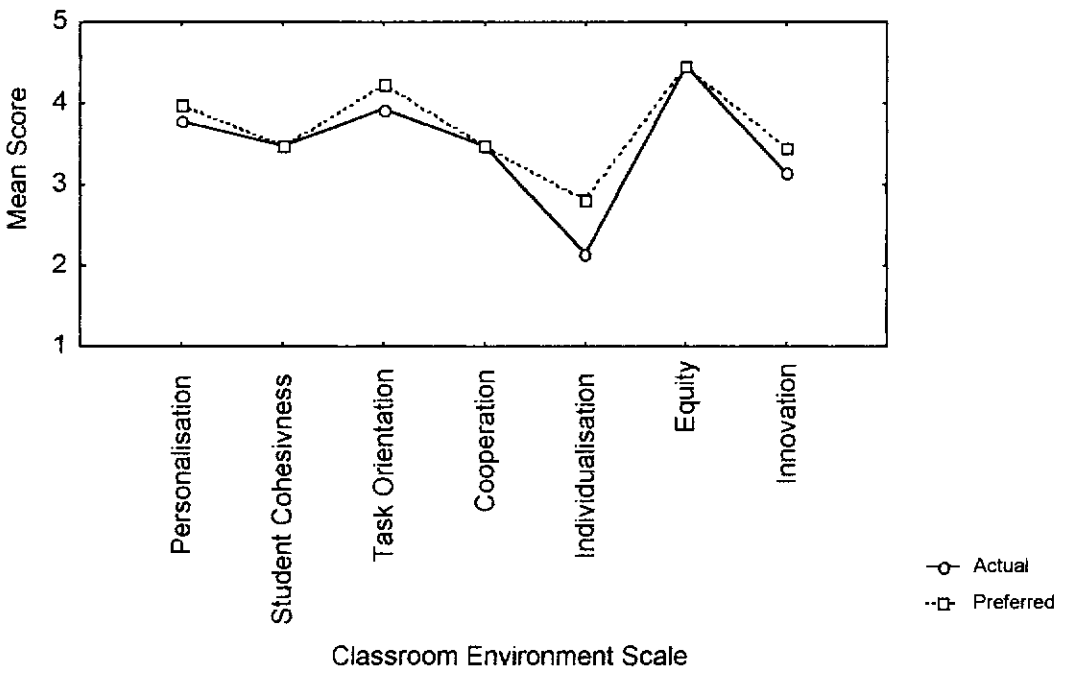

Figure 5.6. Scale mean profiles for mature students for the CUCEI.
Note: Statistically non significant differences are represented as the average of the means (actual & preferred) and appear as the same point on the figure.

However, statistically significant differences were only found in four of the seven scales. The four scales were Personalisation, Task Orientation, Individualisation and Innovation. Mature students seemed also to generally like the 'guided approach' to teaching employed by the instructors at the college, as indicated by the mean value of 3.13 for the Innovation scale. Mature students also indicated that they were treated equally and that they did not perceive any difference in equity. The standard deviations also indicate that mature students were in general agreement in their perceptions of their actual classroom environment, and of their preferred classroom environment.

5.3.3 *Differences in Perception between Mature and First Time students*

When the classroom environments of the mature students were compared (using an independent-samples *t*-test) with those that have come fresh from the senior secondary schools, two out of the four statistically significant scales were perceived more favourably by the mature students. Mature students perceived the scales of Task Orientation and Equity more favourably whereas those below 19 years of age perceived the scales of Personalisation and Individualisation more favourably. These profiles can be found in Table 5.9 and in Figures 5.7 and 5.8. This comparison is limited because of the limited sample size, with only 45 mature students used in the paired *t*-test analysis. Though both mature and younger students preferred a more positive classroom environment, the younger students had a greater preference for a more positive environment.

Younger students also perceived their classes to be less equitable than did the mature students and the difference in the actual perceptions can be gauged from the mean scores which are 4.51 for the mature students and 3.83 for the younger students. The findings here contrast with the findings of Fraser, Treagust, Williamson, and Tobin (1987) in which the least favoured classroom environment were those where adults were integrated with adolescents. However, the findings by Fraser, Treagust, Williamson, and Tobin (1987) were replicated in this study with

respect to the low mean scores by mature students in the Individualisation and Personalisation scales.

Table 5.9
Comparison of Means, Differences and Effect Size between Mature and First Time Students at the Post Secondary level for the Preferred and Actual Forms of the CUCEI

Scale	Form	Mature (M)	First Time (FT)	Difference (FT-M)	t-test Values	Effect Size
Personalisation	Actual	3.78	4.00	0.22	2.23*	0.40
	Preferred	3.98	4.23	0.25	2.45*	0.45
Student Cohesiveness	Actual	3.40	3.30	- 0.10	0.58	- 0.13
	Preferred	3.56	3.96	0.40	2.76*	0.53
Task Orientation	Actual	3.93	2.57	- 1.36	14.79*	- 2.76
	Preferred	4.22	4.35	0.13	1.36	0.25
Cooperation	Actual	3.32	3.33	0.01	0.06	0.01
	Preferred	3.63	4.05	0.42	2.43*	0.47
Individualisation	Actual	2.15	3.43	1.28	11.13**	2.00
	Preferred	2.80	3.08	0.28	1.93	0.35
Equity	Actual	4.51	3.83	- 0.68	5.72**	-1.26
	Preferred	4.40	4.75	0.35	2.82*	0.63
Innovation	Actual	3.13	3.44	0.31	1.65	0.39
	Preferred	3.44	3.34	- 0.10	0.82	- 0.15

* $p < 0.05$ ** $p < 0.01$ n=45 groups

Note:
1. Statistically non significant differences between Mature and First time students are represented on Figure 5.7 as the average of the means (actual & Preferred) and appear as the same point on the figure.
2. Effect sizes were calculated using Cohen's d formula (1977) where the difference in the two means (M-FT), for each scale, is divided by the pooled standard deviation

When the preferred classroom environments were compared, statistically significant differences in the mean values were observed in only four scales. These four scales were Personalisation, Student Cohesiveness, Cooperation and Equity. Mature students reported a greater preference for innovative teaching approaches in their classrooms in comparison to the younger students.

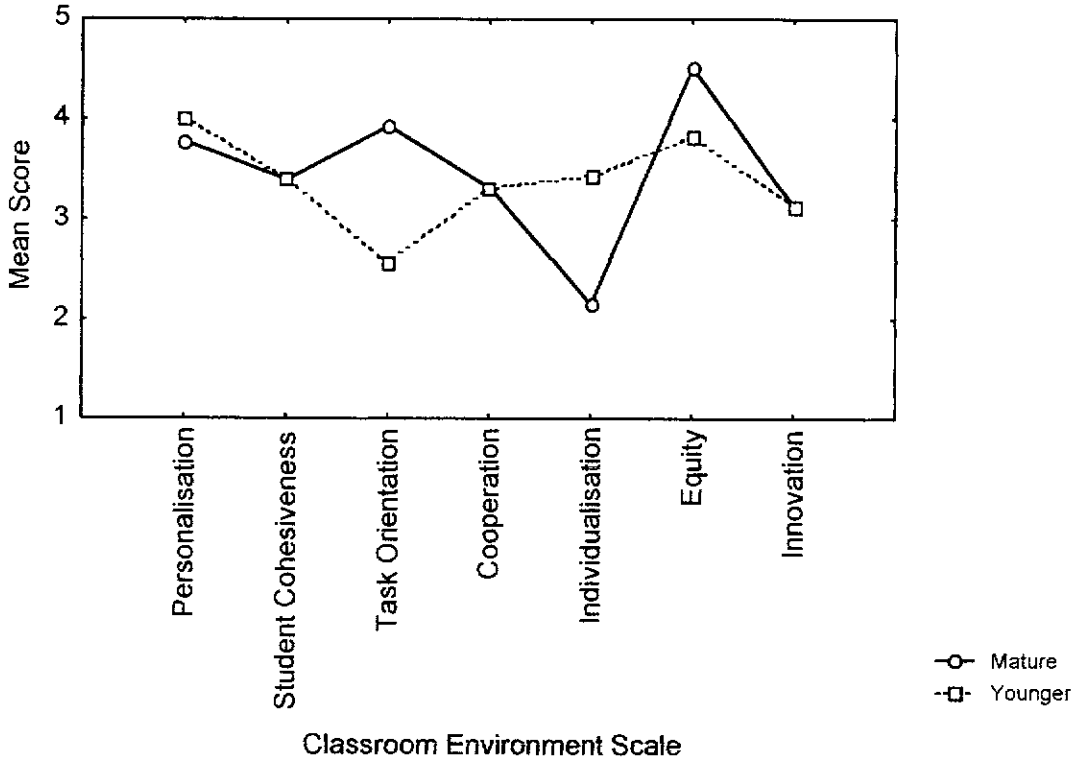

Figure 5.7. Comparison of Actual classroom environment scales for mature and younger students at the post secondary level of studies.

An examination of effect size data in Table 5.9 reveals that the effect sizes between younger and mature students' actual classroom environment perceptions range from 'small' for the Innovation and Personalistion scales to 'large' for the other three scales, with the exception of Student Cohesiveness and Cooperation scales which fell below the minimum operational definition of 0.20. The three scales of Task Orientation, Individualisation and Equity with 'large' effect sizes were also oberved to be highly significant in the mean value differences ($p<0.0001$). On the other hand, effect sizes on the preferred classroom environments range from 'small' for the Personalisation, Task Orientation, Cooperation and Individualisation scales to 'medium' for the Student Cohesiveness and Equity scales. The effect size for the Innovation scale was negligible. Effect size calculations provide confirmation of what was reported in the statistical significance analysis.

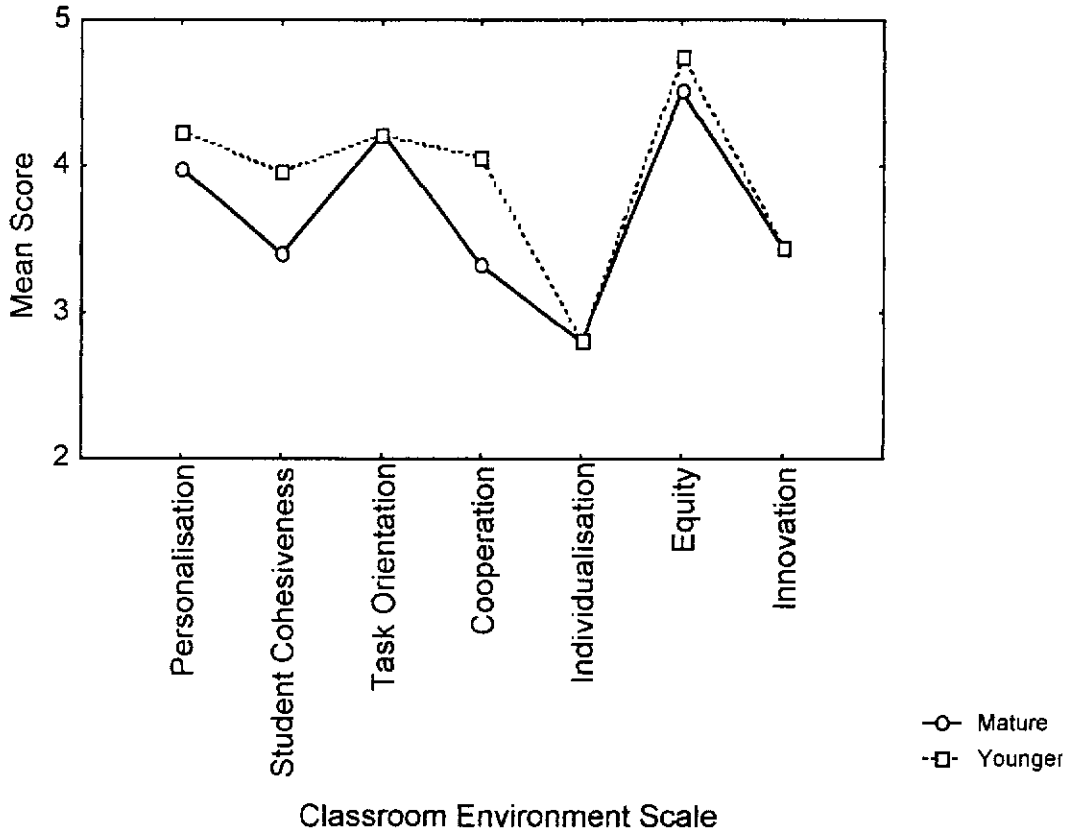

Figure 5.8. Comparison of Preferred classroom environment scales for mature and younger students at the post secondary level of studies.

5.4 Research Objective 4 - Instructors' perceptions

5.4.1 *Instructors' Perceptions of their Classrooms*

Instructors' perceptions of their classrooms are shown in Table 5.10 and Figure 5.9 below. Statistically significant differences between the actual and preferred instructors' perceptions were observed in four out the seven scales. The four scales are Student Cohesiveness, Task Orientation, Equity and Innovation. This result is in step with previous research where the preferred environment is nearly always perceived more favourably (e.g., Fisher & Fraser, 1983; Fraser, 1984; Moos, 1979).

Table 5.10

Means and Standard Deviations for all Instructors in the Study for the Actual and Preferred Forms of the CUCEI

Scale	Mean		Difference	Standard Deviation		*t*-test
	Actual (A)	Preferred (P)	(P-A)	Actual	Preferred	Values
Personalisation	4.15	4.28	+0.13	0.59	0.44	1.37
Student Cohesiveness	4.00	4.33	+0.33	0.50	0.59	1.88*
Task Orientation	4.03	4.40	+0.37	0.47	0.50	3.13**
Cooperation	3.70	3.72	+0.02	0.73	0.62	0.16
Individualisation	2.55	2.63	+0.08	0.92	0.99	0.37
Equity	4.07	4.43	+0.36	0.75	0.63	1.75*
Innovation	2.41	3.42	+1.01	0.63	0.99	4.28**

* $p < 0.05$ ** $p < 0.01$ n=24 pairs

Note: Statistically non significant differences are represented on the respective figures as the average of the means (actual & preferred) and appear as the same point on the figure.

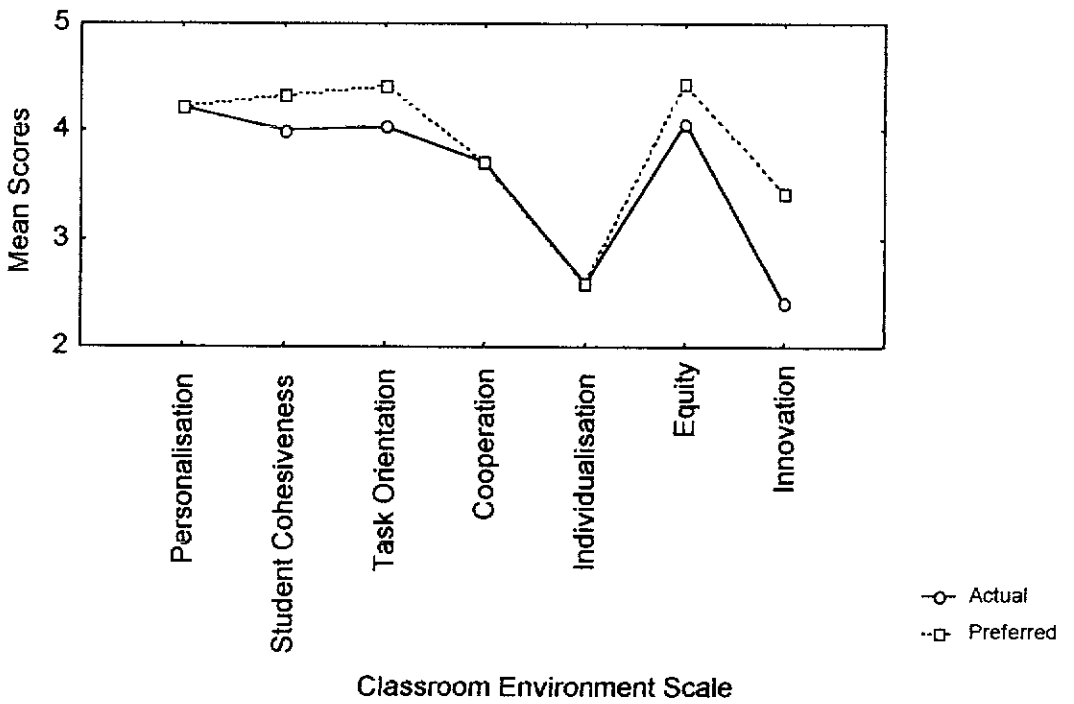

Figure 5.9. Scale mean profile for the instructor version of the Actual and Preferred Forms of the CUCEI.

The largest standard deviations are seen in the preferred scales of Innovation and Individualisation, each of which had a standard deviation of 0.99. The larger standard deviations suggest that instructors had very differing perceptions of their preferred environment as encompassed by these scales. This also suggests that instructors have differing views of the appropriate teaching techniques and activities associated with the classes they teach. The results also indicate that instructors generally preferred greater equity in their classes than that was actually present.

5.4.2 Senior Secondary Instructors

Senior secondary school instructors also showed the same pattern as post secondary instructors in the standard deviations of the statistically significant scales, with the preferred values having a greater spread than the actual values. However, the pattern observed with respect to the actual and preferred mean scores were different (see Figure 5.10 and Table 5.11).

Statistically significant differences between the actual and preferred perceptions of senior secondary instructors were evident only in three of the seven scales namely the Student Cohesiveness, Task Orientation and Innovation scales. The magnitude of this difference for the Innovation scale is about one standard deviation greater than the rest of the scales. This indicates that instructors at the senior secondary level envisaged a better approach to teaching than the present methods they have employed in their classes. Student Cohesiveness had a lower mean value in the preferred form. One possible explanation for the lower mean value at this level could be that instructors want students to be more independent in their work as well, to appreciate that there is a need for some competition in the class to bring out the best in individual abilities.

Instructors generally, both at the senior and post secondary levels, had diverse perceptions of their preferred classroom environment though it can clearly be seen that the perceptions are towards a more positive classroom environment, although the results seem to suggest a somewhat greater contentment among senior secondary

instructors to the classroom environment than that to which they are presently exposed.

Table 5.11
Means and Standard Deviations for the Actual and Preferred Forms of the CUCEI for Senior Secondary Instructors

Scale	Mean		Difference	Standard Deviation		*t*-test
	Actual (A)	Preferred (P)	(P-A)	Actual	Preferred	Values
Personalisation	4.45	4.46	0.01	0.32	0.33	0.02
Student Cohesiveness	4.57	4.11	- 0.46	0.38	0.50	2.54**
Task Orientation	3.90	4.25	0.35	0.52	0.40	2.02*
Cooperation	4.04	3.90	- 0.14	0.57	0.53	0.62
Individualisation	3.07	3.09	0.02	0.59	0.75	0.05
Equity	4.06	4.27	0.21	0.24	0.19	0.64
Innovation	2.46	3.74	1.28	0.75	0.85	4.80**

* $p < 0.05$ ** $p < 0.01$ n=15 pairs

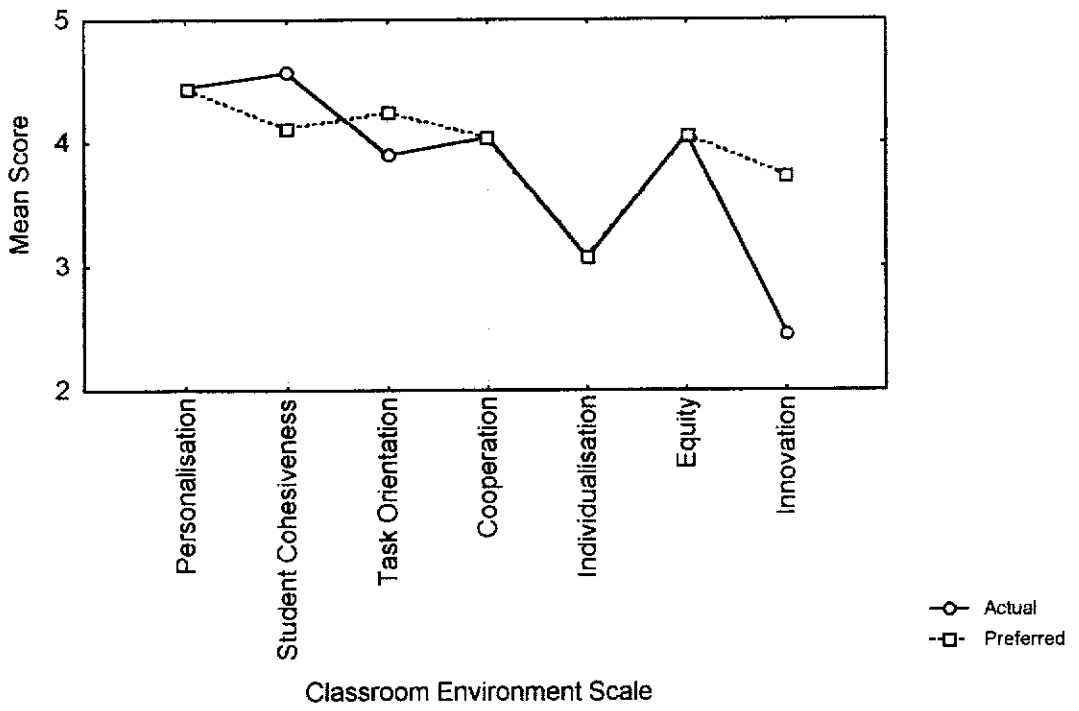

Figure 5.10. Scale mean profile for the Actual and Preferred Forms of the CUCEI for secondary school instructors.

Note: Statistically non significant differences are represented on the respective figures as the average of the means (actual & preferred) and appear as the same point on the figure.

5.4.3 *Post Secondary Instructors*

Table 5.12 and Figure 5.11 report the results of the perceptions of instructors at the post secondary level. Once again, as shown in Figure 5.11, the preferred scores were generally higher than the actual scores with the exception of the Task Orientation scale. This suggests that instructors would prefer less structured classes and the higher level of task orientation in their actual classroom is the result of most instructors employing a 'guided approach' to teaching which is not usual for post secondary classrooms.

Table 5.12
Means and Standard Deviations for the Actual and Preferred versions of the CUCEI for Post Secondary Instructors

Scale	Mean		Difference	Standard Deviation		*t*-test
	Actual (A)	Preferred (P)	(P-A)	Actual	Preferred	Values
Personalisation	3.67	4.02	0.35	0.60	0.48	3.74**
Student Cohesiveness	3.95	3.81	- 0.14	0.44	0.70	0.39
Task Orientation	4.61	4.22	- 0.39	0.33	0.46	2.75**
Cooperation	3.16	3.44	0.28	0.63	0.66	1.87*
Individualisation	1.73	1.91	0.18	0.71	0.91	0.53
Equity	4.08	4.68	0.60	0.47	0.44	3.33**
Innovation	2.34	2.93	0.59	0.13	0.35	1.43

* $p < 0.05$ ** $p < 0.01$ n = 9 pairs

Table 5.12 also indicates that of the seven scales, only four had statistically significant differences in the mean values. These scales are the Personalisation, Task Orientation, Cooperation and Equity scales. The standard deviation figures also reveal that the instructors at the post secondary level were in closer agreement about their actual classroom environment but had somewhat differing perceptions of what their preferred classroom should be like.

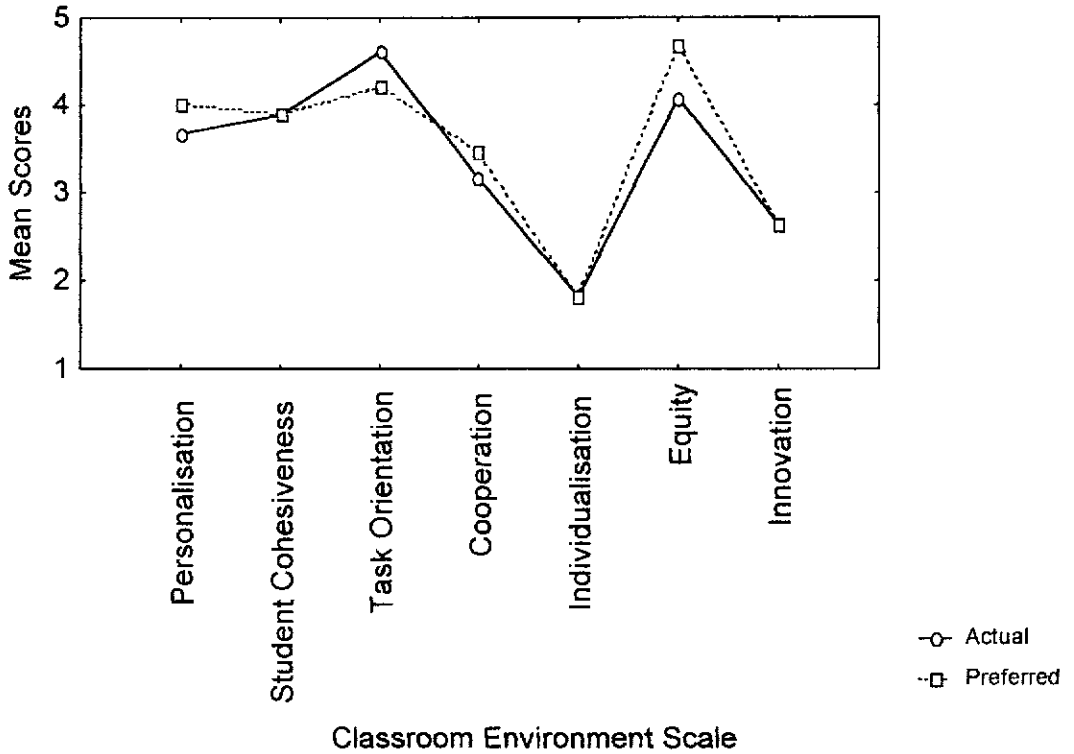

Figure 5.11. Scale mean profile for post secondary instructors in the Actual and Preferred Forms of the CUCEI.

Note: Statistically non significant differences are represented on the respective figures as the average of the means (actual & preferred) and appear as the same point on the figure.

5.4.4 Differences in Perceptions between Instructors

When the actual and preferred classroom environments were compared between the two levels of education, with an independent-samples *t*-test (see Table 5.13, Figures 5.12 and 5.13), the results suggest that instructors at the senior secondary level generally perceived their actual environment more favourably than the instructors at the post secondary level. However, in the Task Orientation scale the post secondary instructors perceived their environment more favourably. The greatest differences were seen in the actual version of Personalisation and Cooperation scales. This finding replicates earlier studies where students transiting to higher levels found their instructors less concerned about their welfare and that they had lesser opportunity for student-instructor interaction (Brendt & Hawkins, 1985; Cotterell, 1979; Hirsh & Rapkin, 1987; Power, 1981; Power & Cotterell, 1981).

Table 5.13

Comparison of Means, Differences and Effect Size for the Actual and Preferred Forms of the CUCEI for Instructors at the Post and Senior Secondary levels

Scale	Form	Post (P)	Senior (S)	Difference (S-P)	t-test Value
Personalisation	Actual	3.67	4.50	0.83	3.00*
	Preferred	4.02	4.31	0.29	2.87*
Student Cohesiveness	Actual	3.95	4.68	0.73	4.76**
	Preferred	3.81	3.91	0.10	0.33
Task Orientation	Actual	4.22	3.83	- 0.39	1.94
	Preferred	4.61	4.09	- 0.52	1.84
Cooperation	Actual	3.16	4.00	0.84	3.33**
	Preferred	3.44	3.91	0.47	1.74
Individualisation	Actual	1.73	3.22	1.49	4.16**
	Preferred	1.91	3.07	1.16	3.85**
Equity	Actual	4.08	4.14	0.06	0.15
	Preferred	4.68	4.13	- 0.55	1.73
Innovation	Actual	2.34	2.69	0.35	1.33
	Preferred	2.93	3.62	0.69	2.70*

** $p < 0.01$ * $p < 0.05$ n= 9 groups

When the preferred forms were analysed only three scales were found to have statistically significant differences in the instructors' perceptions. These scales were Personalisation, Individualisation and Innovation. The greatest difference was found in the Individualisation scale, with senior secondary instructors preferring a greater decision making role by the students in their class. This is opposite to what students would prefer in their classrooms at the post secondary level (see section 5.2.2, pages 108-109).

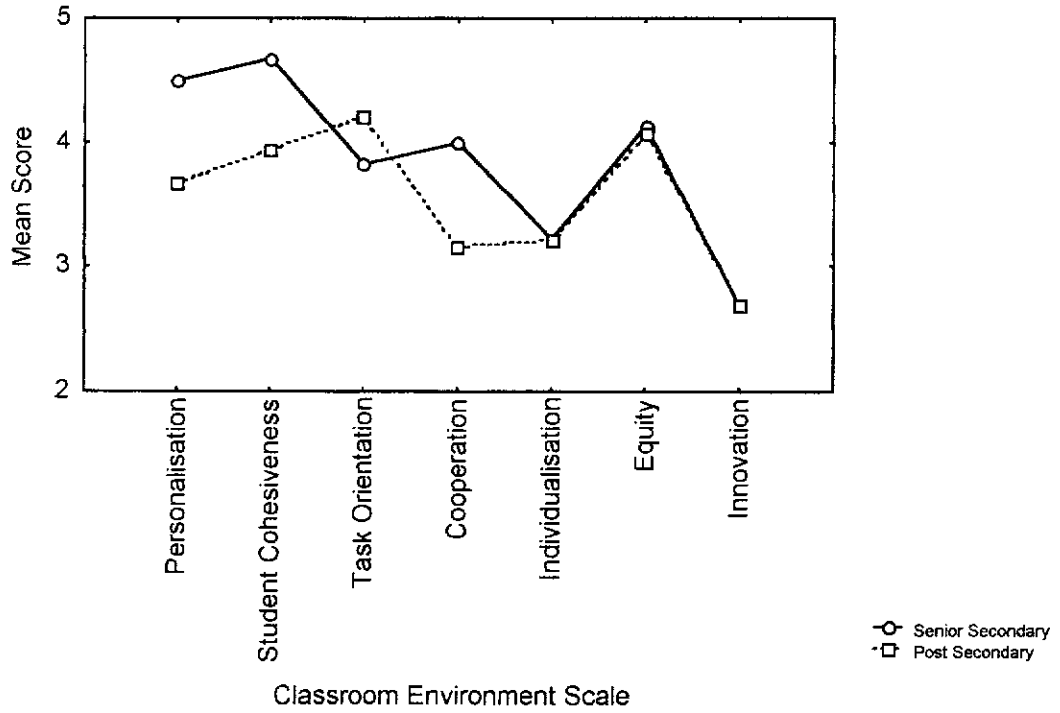

Figure 5.12. Comparison of Instructors' Actual classroom environment scales for the two levels of studies, post and senior secondary.

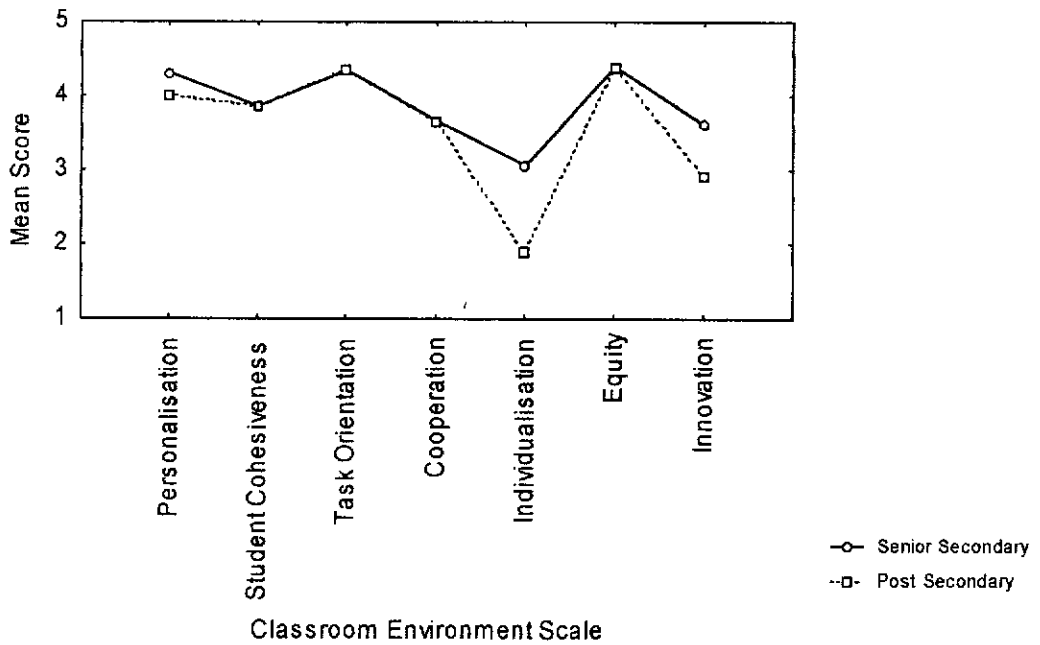

Figure 5.13. Comparison of Instructors' Preferred classroom environment scales for the two levels of studies, post and senior secondary.

Note: Statistically non significant differences in Figures 5.12 and 5.13, between post secondary and senior secondary instructors in the respective scales are represented as the average of the means and appear as the same point in the figures in this section.

Figure 5.13 indicates that instructors at both levels of education were more in agreement of their preferred environment than their actual classroom environment. One significant difference is seen in the Innovation scale where the college instructors seem to want greater innovation in their teaching. This result suggests that instructors at the college are trying to accommodate the changes expected by the students as they move from one level to the next. It could also add weight to their innovative approach to teaching in the first semester at the local college termed in this study as the 'guided approach'.

5.4.5 *Difference between the Perceptions of Students and Instructors*

When a comparison of perceptions was made between instructors and students at the two different levels, the following were observed. Firstly, as in Figure 5.14, the pattern of instructors generally perceiving their environment more favourably than their students was evident with respect to the senior secondary level. This is consistent with previous research (Fraser, 1984; Fraser, Treagust, & Dennis, 1986; Fraser, Treagust, Williamson, & Tobin, 1987; Moos, 1979; Suarez, Pias, Membiela, & Dupia, 1998; Villar, 1995). However, the same pattern observed in previous research, that is, instructors always perceiving their classroom more positively, was less apparent at the post secondary level (see Figure 5.15). Post secondary instructors clearly perceived their environment more favourably in only three of the seven scales, Personalisation, Student Cohesiveness and Task Orientation. A possible explanation could be that at the college level, instructors are more in tune with student preferences and the instructors seem to be accommodating to the changes that students undergo in their environment after transition.

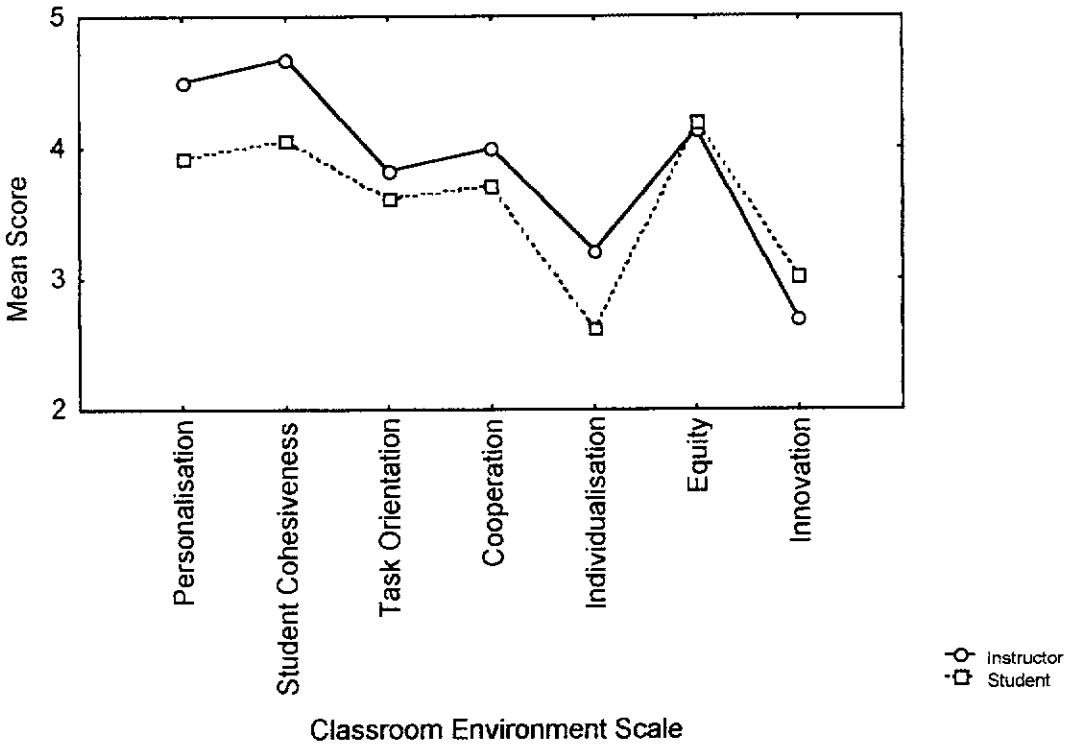

Figure 5.14. Comparison of Actual classroom environment scales between instructors and students at the senior secondary level.

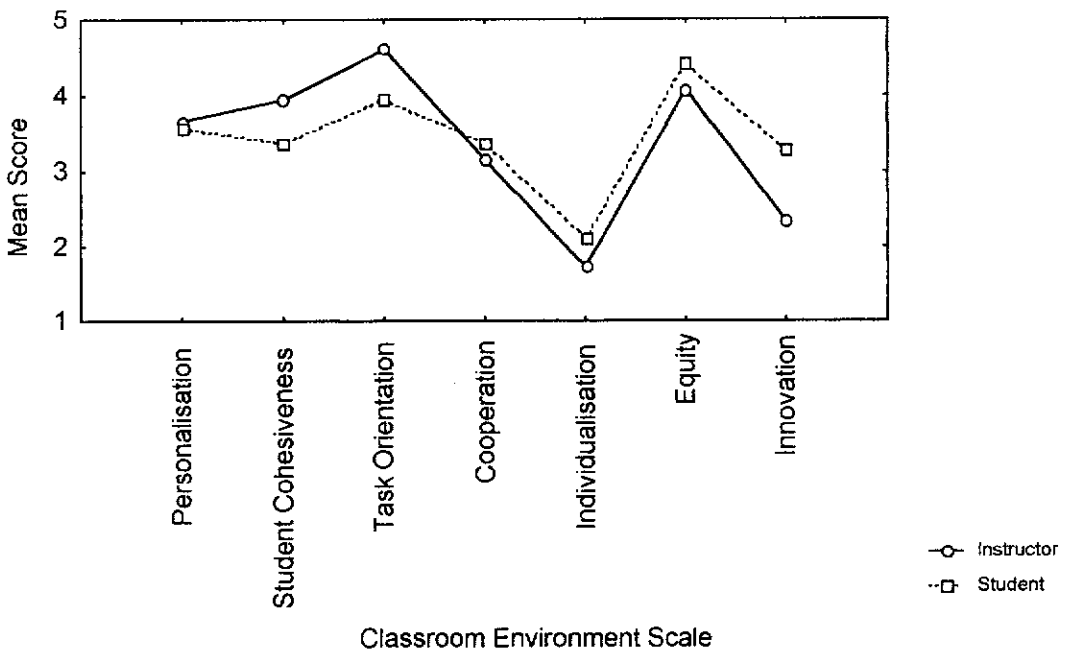

Figure 5.15. Comparison of Actual classroom environment scales between instructors and students at the post secondary level.

Note: Statistically non significant differences are represented on the respective figures as the average of the means (actual & preferred) and appear as the same point on the figure.

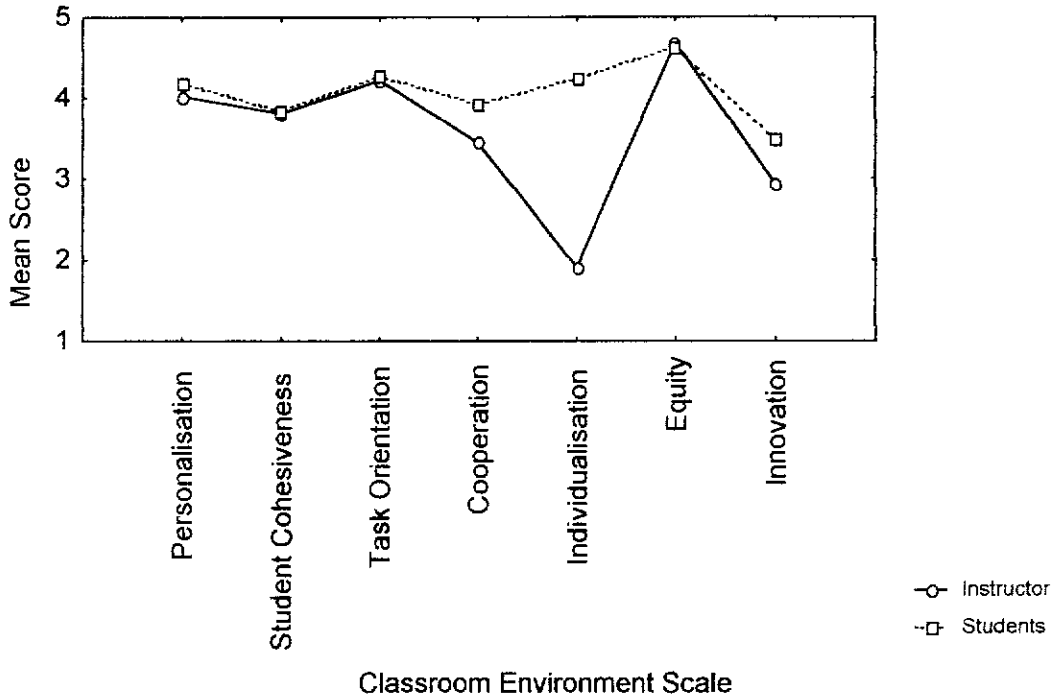

Figure 5.16. Comparison of the Preferred classroom environment scales between instructors and students at the post secondary level.

Figures 5.16 and 5.17 summarise the comparison of the perceptions of the preferred classroom environments between students and instructors at the two different levels of studies. The preference for a positive environment was clearly endorsed at both levels (see Figures 5.16 and 5.17) although the patterns of preference was somewhat different for both levels.

Figure 5.16 suggests that both instructors and students in the post secondary system have about the same preferences for an improved classroom environment but with a greater difference in their perceptions regarding the Individualisation scale. However, Figure 5.17 suggests a somewhat different expectation between instructors and students in the senior secondary system. Instructors preferred a more positive classroom environment than did their students in only two of the scales namely, Task Orientation and Equity. This interesting profile could suggest a greater expectation by the instructors at this level or it could also indicate that the instructors were aware of the different expectations of the students at the higher

level of studies that they were moving into and would like to accommodate these expectations in the change in the environment.

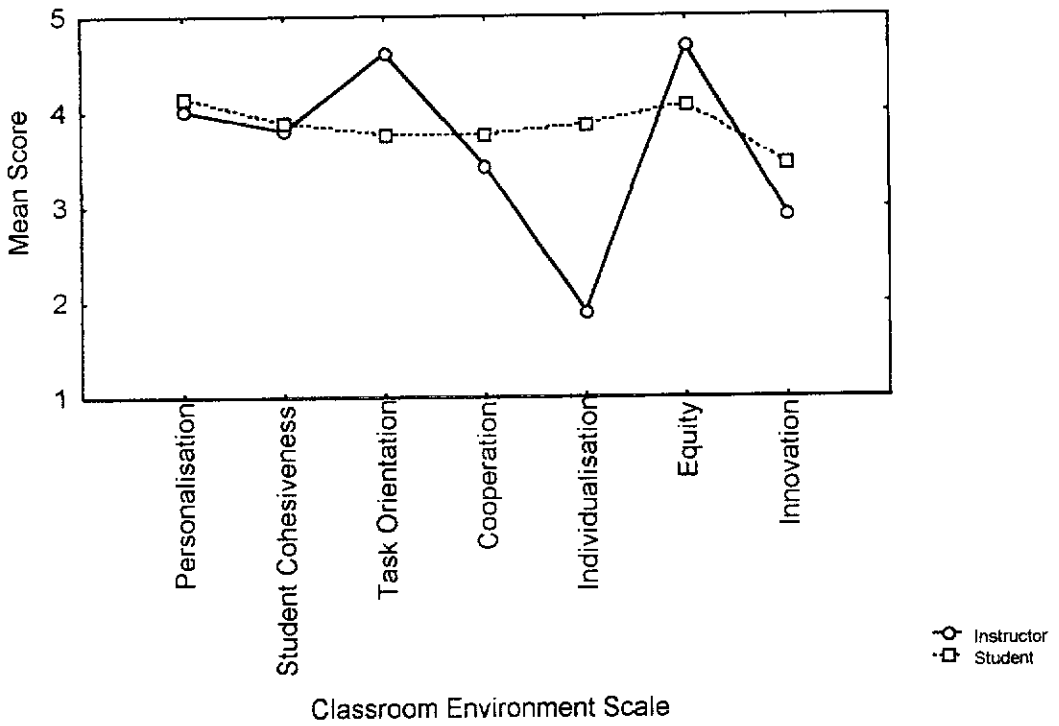

Figure 5.17. Comparison of the Preferred classroom environment scales between instructors and students at the senior secondary level.

The profiles however show a different preference in the Individualisation scale by instructors at both levels compared to the students, with post secondary instructors having a stronger preference than their students. Instructors seem to indicate they are willing to allow some decision making in the post secondary classes and that they also recognise the limitations at the higher levels to accommodate varying interests, student ability and differences in the rate of working of students. This is further supported by comments made by the individual instructors at the post secondary level (pages 102-111, section 5.2.2). However, senior secondary instructors have different perceptions in this area. Students seem to want a greater decision-making role in their classrooms compared to their instructors' preference. This suggests that instructors at the senior secondary level are not too satisfied with the present high involvement the students have in their classes.

5.5 Research Objective 5 -Learning Environments of Post Secondary Instructors

5.5.1 Differences of Perceptions of Students in Three Post Secondary Classrooms

The instructors in Biology, Physics/Mathematics and Computer Studies were interviewed in the study, and there were classroom observations. One objective of this study was to evaluate the classroom perceptions to gauge if the style of teaching at the post secondary level has any bearing on the classroom environment.

Table 5.14
Comparison of Means for the Actual and Preferred Forms of students' perceptions for instructors at the post secondary level

Scale	Form	Instructor 1		Instructor 2		Instructor 3	
		Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Personalisation	Actual	3.92	0.55	3.61	0.62	3.74	0.54
	Preferred	4.23	0.49	4.17	0.59	4.37	0.68
Student Cohesiveness	Actual	3.15	0.67	3.17	0.58	2.96	0.61
	Preferred	3.46	0.72	3.72	0.85	3.92	0.76
Task Orientation	Actual	3.99	0.50	4.24	0.42	3.53	0.54
	Preferred	4.09	0.62	4.32	0.48	4.16	0.57
Cooperation	Actual	3.53	0.97	3.28	0.95	2.99	0.94
	Preferred	3.98	0.75	3.80	0.96	3.87	1.10
Individualisation	Actual	2.17	0.45	2.13	0.65	2.50	0.34
	Preferred	2.93	0.96	2.93	0.79	3.53	0.83
Equity	Actual	4.40	0.68	4.53	0.61	4.42	0.64
	Preferred	4.51	0.63	4.60	0.61	4.59	0.69
Innovation	Actual	3.17	0.56	3.37	0.75	2.50	0.46
	Preferred	3.17	0.58	3.26	0.62	4.12	0.77

N1 = 22 students in the class of Instructor 1
N2 = 43 students in the class of Instructor 2
N3= 17 Students in the class of Instructor 3

In comparing the actual classroom environments of these three instructors, (see Table 5.14 and Figure 5.18) students' perceptions seem to be very dependent on their instructor's style of teaching. Of the three instructors picked in this study, two followed the 'guided' form of instruction, (Instructor 1 and Instructor 2), and the other the normal lecture mode of instruction (Instructor 3). Instructor one lectured in Biology, Instructor 2 in Physics and Mathematics, and Instructor 3 in Computer Studies. The largest standard deviation was observed consistently in the Cooperation scale for all three instructors. This suggests students were not in close agreement about this aspect of the classroom environment in the classes of all three instructors.

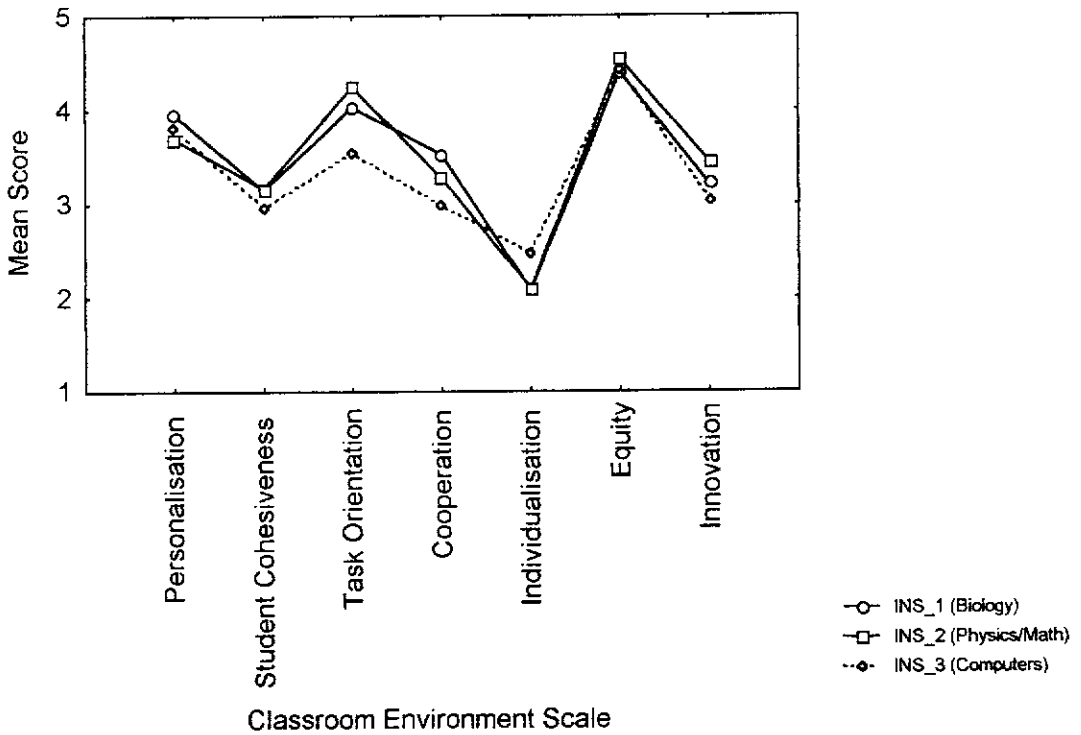

Figure 5.18. Comparison of students' Actual perceptions of the classroom environments in the three classes.

With the exception of the Personalisation and Individualisation scales, Instructor three had generally a lower mean score than the other two instructors. It appears from the data seen in Figure 5.18, that students favour the 'guided' approach to teaching employed by the Biology and Physics/Mathematics instructors. The low

score in the Individualisation scale in all classes could suggest that students perceive there is less choice at the higher level of studies, or that post secondary instructors are less sensitive to differing student abilities and interests.

5.5.1.1 *Instructor 1*

Figure 5-18 shows that for Instructor 1, students generally perceived their classrooms positively. In all the class observations, the elements that compromise the scales of Cooperation and Student Cohesiveness were not apparently observable during the lessons. Cooperation and Student Cohesiveness were not observable because the lessons that were observed did not have students working together in groups or on their assignments. The scales of Personalisation, Task Orientation, Equity, Individualisation and Innovation were observed to complement the findings in the quantitative aspect of this research. The last named scale was perceived very favourably for this instructor, as there were numerous approaches that the instructor used that could be considered innovative in the science classroom. Classroom observations for Instructor one are detailed below and the methodology employed was covered in Chapter 4 of this thesis.

The classroom observation illustrates the above findings: the class started on time with a discussion on the relatively low marks the class had obtained in the recent mid year examination. There was open discussion between students and instructor. The instructor initiated an open discussion on an option to have a make up examination. After about 20 minutes the class resumed the topic for the day which was a lesson on fungi. There was good use of overheads and there was considerable linking with topics covered earlier in the class. A very interactive approach was evident in this class, as students were free to interject and ask questions. The instructor used both the questions posed by students and herself to the students as feedback to ascertain if the material she was covering was understood in general by the class. Class members were generally interested in the lesson as evidenced by the active discussions that took place with the instructor. The instructor's use of overheads was excellent as evidenced by the time the instructor spent on explaining

the significance of the overhead to the topic discussed. Further, the instructor spent time pointing out where the information she was presenting can be found. These references were also placed on the overheads for students to note down. Near the end of the lesson, the instructor gave examples which had a 'hands on' application to the local region in which the students reside. These practical examples made the students more aware of their surroundings and were in fact designed to prepare them for their field work later in the week. This class runs for one and half hours and although the class seemed to enjoy the lesson, it appeared that the length of the class was taking a toll on the attention span of the students at the end of the class. A lot of information was covered in the lesson. The speed at which the lesson proceeded was therefore high in this class.

5.5.1.2 *Instructor 2*

In the case of Instructor 2, the Physics and Mathematics instructor, who also employed the 'guided' form of teaching, the classroom observations were as follows: the class in Physics was mainly on coordinate systems involving forces. The instructor in this class was very meticulous in his approach to teaching. He started the class off by referring the students to the topic of the day in the specific sections in the textbook. He then proceeded to review the topic of the last lesson. The instructor seemed to tie one lesson to the next so that there was continuity. In a very interesting approach he rewrote the formulae covered in the last class. This seemed be a summative list at the left hand side of the blackboard. The class was very much a mathematical Physics class, however, the instructor's relaxed approach made students feel comfortable because there was a stream of questions when they were in doubt. The instructor solved problems in a step by step approach, identifying the need for each step. Once a method had been developed, the instructor followed through with a minimum of two other examples. The further examples were solved by the instructor with the input of students. When the third example was reached, students seemed comfortable in informing the instructor about what the next step should be in solving the problem. The teaching approach was observed to be very systematic in solving such mathematical problems with constant input and feedback

from students. Each example took 20 minutes to solve. The speed at which the material was covered seemed to be acceptable and not too threatening to the students. The instructor stayed back after the class for those students who needed to clarify points in the lesson.

The observations once again complement the findings in that the class perceived the following scales favourably: Task Orientation, Innovation and Personalisation. For the observer, the innovative approach used in this class was interesting and beneficial for a very mathematically oriented course. Supporting this observation was the relatively high value (highest value among the three instructors) reported by the students for the Innovation scale. The class was not handled by the instructor as a traditional lecture mode class.

5.5.1.3 *Instructor 3*

Class observations in Instructor 3's classroom dealing with Computer Studies are consistent with the findings shown in Figure 5.18. Students generally valued the class less positively. In the areas that were observable, Innovation and Task Orientation were valued low by the students. The following were the observations:

Instructor three in this post secondary class maintained a record of the student attendance by marking an attendance register. He introduced the topic and gave an outline of the lesson. The class on computer hardware was covered in more of a lecture mode with very little input or interaction with students. The instructor used analogies that were easily understood by the class. Students were generally writing down notes. The lecturing approach was given very slowly and the lethargic approach was seen to bore the class. Around an hour into the two hour class students signalled for a break. At this point the instructor signalled a short test on the material that had been just covered today in class. Students were aware of this test which was set on a weekly basis. Students had a five minute break and returned for the test which lasted for about five minutes.

The preferred classroom environment for Instructor 3 reported higher mean values in nearly all of the scales in comparison to the classroom environments of Instructor 1 and Instructor 2 (see Figure 5.19). This suggests that students of Instructor 3 would prefer a total overhaul in their classroom environment.

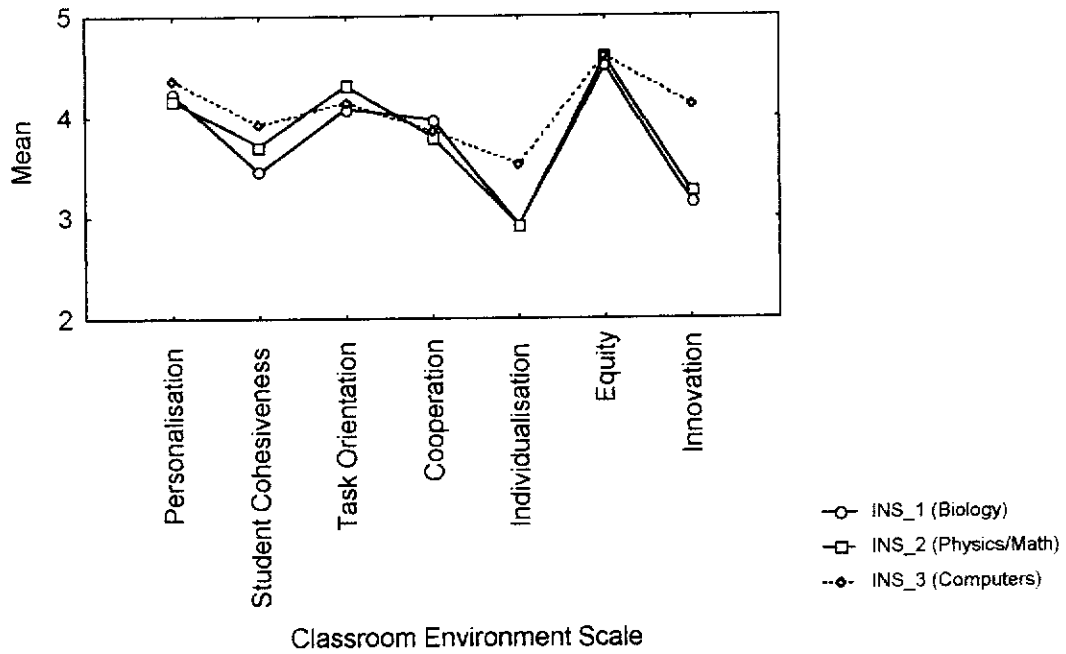

Figure 5.19. Comparison of students' Preferred perceptions of the classroom environments in the three classes.

The approach used by Instructors 1 and 2 was one that involved the students in the classroom lessons, thus incorporating an interactive approach at the post secondary level. The appreciation of the students is seen in the perceptions of the students in these two classes. Students perceived the approach used by Instructor 1 slightly more positively than the teaching approaches of Instructor 2. This could be explained in terms of the course material. The Physics course taught by Instructor 2 was generally a very mathematical concept driven course and students usually find such courses harder to follow and relate to than a course such as Biology. The results of this study support the findings of Chang (1999) where students were found to be more satisfied, interested, and have greater enjoyment in classes with interactive teaching at the tertiary level.

Further complementing these findings are the comments enunciated by the three instructors on the teaching styles that they have adopted in their classrooms. The instructors viewed their teaching as follows;

> *I have never used a formal lecture system. I use a fair amount of handouts, so if you take the standard set of materials, I will give them a handout with the bottom line in terms of vocabulary and concept that they have to know. Depending on the course level, I will also put my lecture notes on reserve. They have this as a fall back. I find straight lecturing - the retention rates with students is not great, they have to get involved with the material, whether you have to make it outrageous at times or whether to peak their interest. I try to teach them more about concepts and get them thinking, not to memorise but understand it.*
>
> *I will actually adjust the sequence of what I am doing and how I am doing it based on the profile of the class. I have certain standards I have to work to and I will achieve this either in a couple of months or in two semesters. I will get to that either sooner or later depending on the class.*
>
> *The results (from the use of this technique) not only come out in the examinations and tests but I have students coming back from subsequent years attending other institutions and they have done quite well.*
>
> *-Biology Instructor*

> *Dinosaur method - repetition, repetition and repetition. Go over and over the material as the course is basically mathematical. Bright ones get it quickly and the ones in the middle which we are after, if they see it many times they should pick it up (by various examples). I ask questions to get feedback.*
>
> *-Physics Mathematics Instructor*

> *I usually give a lecture usually in two parts and often a quiz for them to focus on what they can remember. It is a straight lecture. I consider recall more powerful then recognition.*
>
> *-Computer Studies Instructor*

Clearly, the approach used by Instructors 1 and 2 has been well received by the students in comparison to the approach employed by Instructor 3. Student perceptions of Instructor 3 and the comments by Instructor 3 seem to suggest that this instructor and the students in this class are at odds as to what is considered a classroom environment conducive to learning. The results also seem to suggest that the 'guided' approach to teaching has a positive influence on the learning environment.

5.6 Summary

This chapter has reported the use of the actual and preferred forms of the CUCEI at the senior secondary and post secondary levels with both students and their instructors. The following points are a summary of the results:

- Students generally preferred a more positive environment than that which was present in their actual classrooms.

- Post secondary students perceived their classrooms less favourably than students from the senior secondary level.

- Post secondary students preferred a more positive classroom environment compared with senior secondary students.

- Instructors perceived their classroom environment more favourably than did their students.

- In comparison to younger students, mature students generally perceived their classrooms favourably with the exception of the Personalisation and Individualisation scales.

- Both male and female students perceived their environment almost identically in this study.

- Post secondary instructors perceived their classroom less favourably than did the instructors at the senior secondary level.
- Qualitative data obtained from student and instructor interviews and classroom observations complemented quantitative findings.

Proceeding with the analysis, the link between the classroom environment and the attitudinal outcomes as measured by the Difficulty, Speed of the courses and Satisfaction scales are investigated in the next chapter.

CHAPTER 6

LEARNING ENVIRONMENT AND STUDENT OUTCOMES

6.1 Introduction

An objective of this study was to investigate the associations between students' perceptions of their classroom and their attitudinal outcomes. Three distinct measures were used, satisfaction with the courses taken, speed at which the courses were being delivered and difficulty of courses. These three measures were assessed and justified in Chapters 3 and 4. This chapter details the results of the application of the three attitude scales and examines the relationships between these scales and students' perceptions of the classroom environment. In addition, qualitative data recorded for this study are utilised to complement the findings observed from the quantitative.

This chapter contains two other sections dealing with the three objectives that have been defined earlier in Chapter 1. The first section interprets the results obtained from the attitude scales with respect to the post and senior secondary levels, research objectives six and seven. The second section reports the associations between the classroom environment and student outcomes (research objective eight).

6.2 Research Objectives 6 and 7 - Degree of Difficulty and the Rate at which the Content of the Course is covered

6.2.1 *Comparison of Attitudinal Outcomes*

Differences in students' perceptions were explored in this section in two ways. The first involved the determining of significant differences between post secondary and senior secondary student perceptions using a *t*-test for dependent samples for each of the three measures used in this study. Secondly, effect sizes were calculated in order to indicate the degree and direction of effect between post secondary and senior secondary students' perceptions on each of the three distinct measures of attitude used in this study. Effect sizes were calculated using Cohen's d formula (1977) where the difference in the two group means, for each scale, is divided by the pooled standard deviation. Interpretations on the magnitude of effect size are based on Cohen's (1977) operational definitions of 0.20, 0.50 and 0.80 as being small, medium and large effect sizes, respectively.

Table 6.1
Comparison of Mean, Standard Deviation, Mean Differences and Effect Sizes for Attitudinal Measures at Post and Senior Secondary levels

Scales	Mean		Difference	Standard Deviation		*t*-test	Effect
	Post (P)	Senior (S)	(P - S)	Post	Senior	values	Size
Satisfaction	2.55	2.72	- 0.17	0.49	0.55	2.58**	- 0.29
Difficulty	2.69	2.58	0.11	0.56	0.54	1.57	0.26
Speed	2.44	2.37	0.07	0.42	0.43	1.29	0.21

** $p < 0.05$ n = 205 groups

When students' attitudes were analysed at the two levels utilising the t-test analysis, a significant difference occurred only in the Satisfaction scale (see Table 6.1). Students at the post secondary level were more dissatisfied with their courses in comparison to senior secondary students. A possible explanation for this could be that students who moved from more to less supportive teachers experienced a decline in their valuing of the subject matter.

Interestingly, students at both levels generally did not find that the speed of the courses they were taking needed much alteration. This is reflected generally by the low scores in the mean values, 2.44 and 2.37 out of a possible maximum value of 4.0, for the post secondary and senior secondary levels (see Appendix A for the items and scoring for these three measures). This sentiment was enunciated by students in the interviews;

> *It is pretty fast. It is not a bad thing, it is just fast. I don't have a problem with it.*
>
> *I find the courses are covered quickly but I find it okay.*
>
> *There is a lot more work but it is how you spread it out.*

Students at both levels generally also did not find there was any significant increase in difficulty in the courses they were taking in comparison to the science courses they were pursuing at the senior secondary level. This opinion regarding the level of difficulty of the courses was expressed by students in the interviews;

> *A little more increased [difficulty] since there is more thought to the questions [tests, assignments].*
>
> *Not usually. The course curriculum [at high school] prepared me. I have a good grasp of what is going on.*
>
> *Having come from a private school, I find the workload not great. It is a good challenge [difficulty of courses] to keep up as opposed to high school.*

Qualitative data collected from instructor interviews support student opinions that there is a considerable increase in amount of course content;

We have no control. We have to cover X amount of material before they move on to their second year.

- *Biology Instructor*

It is a university lecture and there is a certain amount of material to cover and you cover it.

- *Physics Instructor*

The findings here are in direct contrast to the study of Chang (1999) where it was reported that the students had found there was increased speed and difficulty in the first year of university level Physics. The results in this study seem to suggest that students at the post secondary level at Northwest Community College have accepted that science courses in higher education would be covered at a faster rate. It seems safe to suggest that students have taken responsibility for their learning and have made adjustments to cope with the increased workload. A possible explanation for students not finding any significant difference in the difficulty of their courses and the speed at which the courses were being delivered could be related to the innovative teaching techniques that are utilised at the post secondary level at Northwest Community College, that being the 'guided' approach. Students have indicated in the previous chapter, section 5.5, that they prefer the innovative approach used in their science classrooms over traditional lecturing methods.

The analysis of the effect size presented in Table 6.1 indicates that in the Satisfaction, Difficulty and Speed scales the effect sizes were 0.29, 0.26, and 0.21 respectively and fall into the 'small' category as per the operational definition of Cohen (1977). Examination of the 'direction' (negative or positive) of effect size reveals that there was a negative effect on post secondary students' perceptions as measured by the factors in the Satisfaction scale and a positive effect in comparison to senior secondary students' perceptions on factors measured by the Difficulty scale. This small but positive effect indicates that students at the post secondary level found that the difficulty of courses they were taking had increased, in comparison to the courses they had taken at the senior secondary level. A similar trend is reported for the Speed scale with a small positive effect.

6.2.2 *Comparison of Attitudes based on Gender of Students*

6.2.2.1 *Post Secondary Level*

A comparison of the scores of male and female students, Table 6.2 below, indicates that only the Satisfaction and Speed scales were significantly different. This suggests that both male and females were generally dissatisfied with their present courses, with male students experiencing greater dissatisfaction. A possible explanation for this could be that male students could have experienced greater changes in the teaching and learning of science when they moved to the higher level of studies. Male students also perceived that the science courses were faster in pace then did the female students.

Table 6.2
Comparison of Mean, Standard Deviation, Mean Differences and Effect Sizes for the *Attitudinal Measures Based on the Gender of Students at the Post Secondary level*

Scales	Mean		Difference	Standard Deviation		*t*-Test	Effect
	Male (M)	Female (F)	(M-F)	Male	Female	Values	Size
Satisfaction	2.41	2.67	- 0.26	0.39	0.55	3.07**	- 0.50
Difficulty	2.63	2.73	- 0.10	0.56	0.57	1.07	- 0.18
Speed	2.51	2.37	0.14	0.50	0.31	2.09*	0.29

** $p < 0.01$ * $p < 0.05$ n = 65 groups

Interpretation of the magnitude of effect sizes reveals that the Satisfaction scale has an effect size of 0.50, a 'medium' effect, whereas the Speed scale with an effect size of 0.29 was found to be within the 'small' operational setting. Effect size for the difficulty scale was 0.18 which was below the smallest allowable setting of 0.20. The 'direction' and magnitude of the effect sizes support observations from the t-test analysis with respect to mean difference between male and female students, that being male students were less satisfied with their science classrooms. Effect size results also indicate that female students found the rate at which courses were delivered to be more favourable than did males. However, though t-test analysis did

not reveal any significant differences in student perceptions between both levels for the measure of Difficulty, effect size data reveal that male students found the courses less difficult.

6.2.2.2 Senior Secondary Level

Table 6.3 provides the information on attitudinal differences between male and female students at the senior secondary level. Statistically significant differences between male and female students' attitudes occurred only in the Satisfaction scale. From the reported mean values in Table 6.3, female students perceived greater satisfaction in the science courses in comparison to male students.

Table 6.3
Comparison of Mean, Standard Deviation, Mean Differences and Effect Sizes for Attitudinal Measures Based on the Gender of Students at the Senior Secondary level

Scales	Mean		Difference	Standard Deviation		*t*-Test Values	Effect Size
	Male (M)	Female (F)	(M-F)	M	F		
Satisfaction	2.74	3.00-	0.26	0.51	0.68	2.00**	0.43
Difficulty	2.81	2.63	0.18	0.53	0.56	0.80	- 0.33
Speed	2.38	2.34	0.04	0.59	0.30	0.37	- 0.09

** $p < 0.01$ n = 34 groups

Effect sizes in this comparison fall into the 'small' category for all scales with the exception of the Speed scale which has a negligible effect size at 0.09. Effect size results confirm the observations from the t-test analysis with respect to mean difference between male and female students' perceptions, that is satisfaction was greater for female students in comparison to male students. Effect size data also reveal that there was a small effect on male students perceptions on items measured by the Difficulty scale.

6.2.2.3 Post Secondary vs Senior Secondary Levels

Table 6.4 below summarises the mean scores at the individual levels. This comparison is based on students from Canada in their post secondary and senior secondary levels. Of the three scales, only one showed a significant statistically difference. The difference was seen only in the Satisfaction scale for male students at the two respective levels, the post secondary and senior secondary levels.

Table 6.4
Comparison of Mean and Effect Sizes for Attitudinal Measures Based on the Gender of Students

Scales	Gender	Post (P)	Senior (S)	Difference (P-S)	Standard Deviation (P)	Standard Deviation (S)	*t*-test Values	Effect Size
Satisfaction	Male	2.44	2.74	- 0.30	0.40	0.51	3.13**	0.62
	Female	2.72	3.00	- 0.28	0.60	0.68	1.76	0.42
Difficulty	Male	2.69	2.81	- 0.12	0.55	0.53	1.45	0.22
	Female	2.81	2.63	0.18	0.54	0.56	1.26	- 0.32
Speed	Male	2.52	2.38	0.14	0.52	0.59	0.82	- 0.25
	Female	2.37	2.34	0.03	0.30	0.30	0.36	-0.10

** $p < 0.01$ n = 34 pairs

Table 6.4 also indicates the magnitude and direction of the effect sizes. Effect sizes for the Satisfaction scale show a positive 'medium' and 'small' effect for the male and female students respectively. This reveals both male and female students at the senior secondary level were more satisfied with their science courses in comparison to the post secondary students. Effects were generally in the 'small' category, 0.22 for males and 0.32 for females with respect to the Difficulty scale. The 'direction' of the effect for female students was negative, revealing that the female students found their science courses at the senior secondary level. However, the 'direction' for males students was positive suggesting that males students found their courses easier at the post secondary level than at the senior secondary level. In the Speed scale the effect sizes reported were 0.25 and 0.10 for males and females respectively. The

effect size for female students was below the smallest operational setting of 0.20 (Cohen, 1977), whereas the effect size for male students showed a small but negative effect when male students moved from their senior secondary to the post secondary level of study.

6.2.3 *Attitudes in the Three Post Secondary Classes*

Table 6.5 below reports the differences in student attitude perceptions of the three instructors at the post secondary level. Further support for the 'guided' approach used in two of the three classes is seen when the attitudes of the students are analysed (see Chapter 5, section 5.5). As seen in Table 6.5, attitudes expressed in the three classes with the three instructors were different. Instructor 1 was perceived by her students quite favourably in all three scales, averaging a mean score of between 2.56 to 2.71 out of a possible maximum of 4. Further, support for this class's appreciation in the way the instructor handled her class can be seen in the generally positive attitude students had in this Biology class and is exemplified by the observations illustrated in Chapter 5, section 5.5. Supporting this further are the positive effect size values in the Satisfaction scale of 'small' and 'medium' observed when the Biology course is compared to the Physics/Mathematics and Computers science courses.

Instructor 2's courses were judged to be difficult, which was understandable as Instructor 2 taught Physics and Calculus. This was confirmed with a paired t-test analysis which showed statistically significant differences between the Computer Science course and the Physics/Mathematics courses (see Table 6.5). The way the instructor approached the delivery of the lesson, though considered by the research observer as somewhat innovative, is supported by a reasonable mean value in the Difficulty scale (mean value of 2.85 out of a maximum possible of 4.0, see Table 6.5) that students gave to the measure of the difficulty of the course. Students perceived the course content not as difficult as one would have assumed by observing the class lesson in progress. A possible explanation in students finding the mathematical course content not as difficult could lie in the way the instructor

delivered his lessons. Supporting this are the classroom observations made by researcher (see Chapter 5, section 5.5.1.2, pages 135-138). Further support for the teaching approaches could be attributed to the statement made by Instructor 2:

> *Go over and over the material as this course is basically mathematical. Bright ones get it quickly and the ones in the middle which we are after, if they see it many times they should pick it.*

Table 6.5
Comparison of Means and Effect Sizes for the Attitudinal Scales for the three Science Instructors

Instructor	Mean	Difference	t-test Values	Effect Size
Satisfaction				
Biology	2.71	0.15	0.83	0.29
Physics/Math	2.56			
Biology	2.71	0.34	1.64	0.97
Computer Science	2.37			
Physics/Math	2.56	0.19	2.36*	0.37
Computer Science	2.37			
Difficulty				
Biology	2.71	- 0.14	0.62	0.24
Physics/Math	2.85			
Biology	2.71	0.31	1.62	0.58
Computer Science	2.40			
Physics/Math	2.85	0.44	2.64*	0.81
Computer Science	2.41			
Speed				
Biology	2.68	0.13	0.91	0.30
Physics/Math	2.55			
Biology	2.55	0.44	3.38**	1.00
Computer Science	2.11			
Physics/Math	2.55	0.44	3.38**	0.97
Computer Science	2.11			

* $p < 0.05$ ** $p < 0.01$ n = 17 groups

The data in Table 6.5 also reveal statistically significant differences in students' perceptions with respect to the level of satisfaction in various classes. This difference was only observed in the comparison of the Physics/Mathematics classes with the Computer Science classes. Students perceived greater satisfaction in the Physics and Mathematics classes taught by Instructor 2.

Effect sizes confirm a 'large' positive effect in that students in the Physics and Calculus classes perceived these science classes as more difficult than the Computer Science course. However, the magnitude and positive 'medium' effect size revealed in the comparison of Biology and Computer science courses indicate that the Biology class was also perceived to be more difficult than the Computer science course. A small effect size of 0.24 is evident when the Biology and Physics/Mathematics classes were compared, indicating that Biology was perceived to be less difficult than the Physics/Mathematics classes.

The data in Table 6.5 also indicate that the Biology and Mathematics and Physics courses were delivered at a faster rate than the Computer Science course. The 'large' effect sizes reported in Table 6.5 confirm the results of the t-test analysis on the differences in perceptions in the respective classes of the three instructors. Further support for this is reported in the classroom observations by the researcher (see section 5.5.1, pages 133-140). Further supporting this are the comments enunciated by the students and the instructors in the interviews:

> *Difficulty - No, I don't. Nature of the course is such a lot of easy things and a few difficult things.*
>
> *- Computer Science Instructor*

> *I use a fair amount of handouts, so if you take the standard set of materials, I will give them a handout with the bottom line in terms of vocabulary and concept that they have to know. I have certain standards I have to work to and I will achieve this either in a couple of months or in two semesters.*
>
> *-Biology Instructor*

6.2.4 *Mature and Younger Students*

Significant differences in perception were found in all three scales. Younger students found the courses more difficult and taxing than the mature students (as defined in section 5.3.3). This is reflected by the higher means reported by the younger students. In step with these findings, younger students were less satisfied with their science classrooms (see Table 6.6).

Table 6.6
Comparison of Means Standard Deviations, Differences and Effect Sizes for the *Attitudinal Measures between Mature and Younger Students*

Scales	Mean		Difference	Standard		*t*-Test	Effect
	Mature (M)	Younger (Y)	(M-Y)	Deviation (M)	(Y)	Values	Size
Satisfaction	2.69	2.52	0.17	0.50	0.52	5.46**	0.33
Difficulty	2.45	2.82	- 0.37	0.48	0.60	3.84**	- 0.67
Speed	2.29	2.57	- 0.28	0.29	0.56	3.25*	-0.65

**p < 0.01 *p < 0.05 n = 45 groups

On examining the effect size based on Cohen's (1977) operational definition all three scales reported 'medium' effect sizes ranging from 0.65 to 0.67. Effect size results confirm the observations from the t-test analysis with respect to mean differences between mature and younger students' perceptions, with younger students perceiving the science courses as more difficult and faster in pace. Effect size also indicates a positive effect on the perceptions of the mature students towards their science classes as measured by the items in the Satisfaction scale.

6.3 Research Objective 8 - Associations between Class Environment and the Attitude of Students

6.3.1 *Associations Between Students' Perceptions of their Learning Environment and Attitudinal Outcomes.*

Tables 6.7 and 6.8 in this section reports the simple correlation (r), which describes the bivariate associations between an attitudinal measure and each CUCEI scale, and the standardised regression weight (β), which characterises the associations between a measure and a particular environment scale when all other CUCEI scales are controlled.

6.3.1.1 *Post Secondary Level*

Table 6.7
Associations Between CUCEI Actual Scales and the Attitudinal Measures in Terms of Simple Correlation (r) and Standardised Regression Coefficients (β) for Post Secondary Students

CUCEI Scales	Attitudinal Measures					
	Speed		Difficulty		Satisfaction	
	r	*β*	*r*	*β*	*r*	*β*
Personalisation	-0.30*	0.07	- 0.14	0.05	0.38*	0.04
Student Cohesiveness	-0.42*	- 0.16	- 0.37*	-0.34**	0.46*	0.18*
Task Orientation	-0.36*	- 0.10	0.06	0.02	0.70*	0.53**
Cooperation	-0.25*	0.06	- 0.22*	0.06	0.24*	- 0.03
Individualisation	-0.46*	- 0.32**	- 0.53*	-0.41**	0.13	-0.09
Equity	-0.34*	- 0.17*	0.07	0.12	0.53*	0.12
Innovation	-0.46*	- 0.20*	- 0.29*	- 0.11	0.37*	0.09
Multiple Correlation, R		0.60**		0.61**		0.74**
R^2		0.36		0.38		0.54

*p<0.05 **p<0.001 n = 130

An examination of the simple correlation (r) results in Table 6.7 indicates that of the seven possible relationships between the learning environment scales and the attitude measures, all seven were significantly related to the student Speed outcome (p<0.05). The simple correlation (r) figures also indicate that four scales of CUCEI,

namely, Student Cohesiveness, Cooperation, Individualisation and Innovation were significantly related to the attitudinal measure of Difficulty and all but the individualisation scale with the measure of Satisfaction.

A similar examination of the multiple correlation weights (β), however, reveals that only seven of the 21 possible relationships are statistically significant to the student outcomes of Speed, Difficulty and Satisfaction. For the Speed outcome the relationships were with respect to Individualisation, Equity and Innovation, whereas with the Difficulty outcome the relationships were with the Student Cohesiveness and Individualisation scales. Lastly, for the Satisfaction outcome the learning environment scales significantly related to this measure were Student Cohesiveness and Task Orientation.

6.3.1.1.1 Speed

The simple correlation (r) figures reported in Table 6.7 indicate statistically significant associations between students' perceptions on all seven learning environment scales and the Speed outcome. These findings suggest that as the speed at which courses are covered increases, the classroom environment characterised by all seven scales is perceived more negatively by students.

The multiple regression (R) correlation, at a value of 0.60 ($p<0.001$), indicates a significant association between the classroom environment, as measured by all the CUCEI scales and the speed at which the courses are taught. The R^2 figure indicates that 36% of the variance in students' attitude as measured by the speed at which courses are covered can be attributed to students' perceptions of the science classroom environment.

An examination of the attitudinal outcome (as measured by the Speed scale) with standard regression weights (β) data, indicates that three of the seven scales retain their statistical significance. This more conservative analysis suggests that three out of the seven scales in the CUCEI, namely, Individualisation, Equity and Innovation,

are the most influential in this outcome. The data suggest that increasing the speed of the courses would reduce Individualisation, Equity and Innovation in the classrooms.

6.3.1.1.2 *Difficulty*

The simple correlation (r) data indicates that four scales of the CUCEI, namely, Student Cohesiveness, Cooperation, Individualisation and Innovation, were significantly related to the Difficulty outcome. The ß values suggest that two scales, Student Cohesiveness and Innovation are most influential regarding this outcome. The ß values indicate that there is an inverse relationship between the level of difficulty and the level of Individualisation and Student Cohesiveness; that is increasing the level of difficulty of the courses would reduce the level of Individualisation and Student Cohesiveness in the classrooms.

The multiple regression (R) correlation, at a value of 0.61 ($p<0.001$), indicates a significant association between the classroom environment, as measured by all the CUCEI scales, and the degree of difficulty of the courses taken. The R^2 figures indicate that 38% of the variance in students' perceptions of how difficult the course is can be explained by students' perceptions of the science classroom environment.

6.3.1.1.3 *Satisfaction*

The simple correlation (r) statistic indicates statistically significant associations between the Satisfaction outcome and all the CUCEI scales except Individualisation. The interpretation of these correlations suggest that classroom Satisfaction was higher in classes characterised by greater Personalisation, Student Cohesiveness, Task Orientation, Cooperation, Equity and Innovation, and particularly in classes where students perceived higher levels of Student Cohesiveness and Task Orientation.

In the final measure of attitudes as assessed by the items in the Satisfaction scale, the multiple regression (R) correlation, at a value of 0.74 ($p<0.001$), indicates a

significant association between the classroom environment, as measured by all the CUCEI scales, and students' satisfaction with the course students are taking. The R^2 figure with respect to this measure, indicates that 54% of the variance in students' attitude as measured by their satisfaction in their courses can be attributed to students' perceptions of the science classroom environment.

The (β) data on the other hand indicates that only two of the seven scales retain their statistical significance in the more sensitive test. This analysis suggests that these scales of Student Cohesiveness and Task Orientation are the most influential scales in promoting greater satisfaction in the science classrooms.

6.3.1.2 Senior Secondary Level

Table 6.8
Associations Between CUCEI Actual Scales and the Attitudinal Measures in Terms of Simple Correlation (r) and Standardised Regression Coefficients (ß) for Senior Secondary Students

CUCEI Scales	Attitudinal Measures					
	Speed		Difficulty		Satisfaction	
	r	ß	*r*	ß	*r*	ß
Personalisation	-0.15*	- 0.04	0.03	0.10	0.40*	0.15*
Student Cohesiveness	-0.01	- 0.04	0.03	- 0.03	0.17*	0.02
Task Orientation	-0.08	- 0.01	- 0.03	- 0.09	0.40*	0.24
Cooperation	0.05	0.03	0.02	0.03	0.23*	0.08*
Individualisation	-0.26*	- 0.24**	- 0.17*	- 0.20**	0.23*	0.27*
Equity	-0.10	- 0.02	0.01	- 0.02	0.26*	0.08
Innovation	0.08	- 0.06	- 0.05	- 0.10	- 0.27*	- 0.09
Multiple Correlation, *R*		0.31**		0.22**		0.52**
R^2		0.10		0.05		0.27

*p<0.05 **p<0.01 n = 374

An examination of the simple correlation (r) results in Table 6.8 indicates that of the seven possible relationships between the learning environment scales and the attitudinal measures, all seven were significantly related to the student Satisfaction outcome (p<0.05). The simple correlation (r) figures also indicate that two scales of

the CUCEI, namely, Personalisation and Individualisation, were significantly related to the attitudinal measure of Speed and only one scale, the Individualisation scale, with the attitudinal measure of Difficulty.

6.3.1.2.1 *Speed*

The simple correlation (r) figures reported in Table 6.8 indicate statistically significant associations between the Speed outcome and two scales of the CUCEI, these scales being Personalisation and Individualisation. These findings suggest that as the speed at which courses are covered increases, the students' perceptions of the level of personalisation and individualisation decreases.

An examination of the attitudinal outcome (as measured by the Speed scale) with standard regression weights (β) data, indicates that only one scale retained its statistical significance. This more conservative analysis suggests that the Individualisation scale is the most influential regarding this outcome. The data also suggest that an increase in the speed of the courses, would reduce the level of Individualisation.

The multiple regression (R) correlation, with a value of 0.31 ($p<0.001$), indicates a statistically significant association between the classroom environment, as measured by all the CUCEI scales, and the speed at which the courses are taught. The R^2 figure indicates that 10% of the variance in students' attitude as measured by the speed at which courses are covered can be attributed to students' perceptions of the science classroom environment.

6.3.1.2.2 *Difficulty*

The simple correlation (r) data indicate that only one scale of the CUCEI, namely, Individualisation was significantly related to this outcome. The β value suggests that this same scale is the most influential regarding this outcome. The β values indicates that as the courses get more difficult the level of individualisation perceived by the student decreases.

The multiple regression (R) correlation, with a value of 0.22 ($p<0.001$), indicates a significant association between the classroom environment, as measured by all the CUCEI scales, and the degree of difficulty of the courses taken. The R^2 figures indicates that 5% of the variance in students' perceptions of how difficult the course is can be explained by students' perceptions of the science classroom environment.

6.3.1.2.3 *Satisfaction*

The simple correlation (r) statistic indicates statistically significant associations between the Satisfaction outcome and all seven scales of the CUCEI. The interpretation of these correlations suggest that classroom Satisfaction was higher in classes characterised by greater Personalisation, Student Cohesiveness, Cooperation, Task Orientation, Individualisation, Equity and Innovation. The simple correlation figures also indicate that reducing innovative approaches to teaching increases satisfaction. However, this factor does not retain its statistical significance in the more conservative analysis with standard regression weights. The beta weights on the other hand indicate that only two of the seven scales retain their statistical significance. This analysis suggests that the scales of Cooperation and Individualisation are the most influential in promoting greater satisfaction in the science classrooms.

In the final measure of attitudes as indicated by the items in the Satisfaction scale, the multiple regression (R) correlation, at a value of 0.52 ($p<0.001$), indicates a significant association between the classroom environment, as measured by all the CUCEI scales, and the Satisfaction of the course students are taking. The R^2 figures with respect to this measure indicates that 27% of the variance in students' attitude as measured by their satisfaction in their courses can be attributed to students' perceptions of the science classroom environment.

6.4 Summary

This chapter has reported the results of the application of the three attitudinal scales and the relationships of these scales with students' perceptions of their classroom environment. The following points are a summary of the results:

- Senior secondary students were more satisfied with their science courses in comparison to students at the post secondary level.

- Female students at the post secondary were less concerned with the speed of their courses in comparison to male students at the same level.

- Female students at the post secondary level were more satisfied with their science courses than were the male students at the same level.

- Senior secondary female students were more satisfied with their science courses in comparison to male students at the same level.

- Mature students were more satisfied with their science courses than the younger students.

- For post secondary classes
    i) Student Cohesiveness and Task Orientation were significantly related to the attitudinal measure of Satisfaction;
    ii) Student Cohesiveness and Individualisation were significantly related to the attitudinal measure of Difficulty; and
    iii) Individualisation, Equity and Innovation were significantly related to the attitudinal measure of Speed.

- Post Secondary classes perceived the scales of Student Cohesiveness and Task Orientation as the most influential in promoting greater satisfaction in the classroom.

- Post secondary students perceived that increasing innovation would reduce the Speed at which the courses would be delivered.

- For senior secondary classes
    i) Cooperation, and Individualisation were significantly related to the attitudinal measure of Satisfaction;
    ii) Individualisation was significantly related to the attitudinal measure of Difficulty; and
    iii) Cooperation and Individualisation were significantly related to the attitudinal measure of Speed.

- Senior secondary classes perceived two scales of the CUCEI, namely, Individualisation and Cooperation, to be the most influential in promoting greater Satisfaction in the classroom.

Chapter 7 in the thesis summarises the findings in this research, considers the limitations of this study, and suggests some directions for future studies.

CHAPTER 7

CONCLUSIONS

7.1 Introduction

Many instruments have been designed to measure the students' classroom learning environment perceptions (Fraser, 1986, 1991, 1994, 1998a, b; Fraser & Fisher, 1994; MacAuley, 1990). However, with respect to the learning environment at tertiary levels there has been very limited work. One instrument that has been used at this level is the College and Universities Classroom Environment Inventory (CUCEI).

Although numerous past studies have examined students' perceptions of the learning environment in science classes (Fisher & Cresswell, 1997; Fraser, Treagust, Williamson, & Tobin 1987; Suarez, Pias, Membiela, & Dapia, 1998; Villar, 1995; Yarrow, Millwater, & Fraser, 1997; Yuen-Yee & Watkins, 1994) and student outcomes (e.g., Fraser & McRobbie, 1995; Teh & Fraser, 1995; Wong & Fraser, 1996), this study in this thesis is unique in that a) it is the first classroom environment research study involving students both in the high schools and first year university level in Northwest British Columbia, Canada; b) the study focuses on the perceptions of the classroom environment of students moving from their final year of high school to the first year of university work at a community college; and c) the

modified and personal forms of the CUCEI have never been used previously in a research study. Furthermore, this is the first study in which the CUCEI has been modified and personalised for use for higher education settings.

7.2 Overview of the Study

The objectives of this study were to:

1. develop and validate a personal form of the College & University Classroom Environment Inventory (CUCEI);

2. use the modified CUCEI to investigate how students at Northwest Community College and at Senior Secondary Schools differ in their perceptions of their classroom environments;
3. investigate if the students' gender and age influences their perceptions of their classrooms.

4. compare how instructors at the college and senior secondary schools perceive their classroom environment;

5. compare the learning environments of the instructors at Northwest Community College (NWCC) who do and do not employ a 'guided' approach to teaching;

6. compare and contrast the degree of difficulty faced by students in their post secondary and senior secondary classrooms;

7. determine students' perceptions regarding the rate at which the content of the course is covered both at the post secondary and senior secondary levels; and,

8. compare associations between the nature of the classroom environment and the attitudes of the students towards their science studies at the college and senior secondary levels.

In addressing the above objectives, this thesis is presented in seven chapters. Chapter 1 outlines the background and significance of this study and the proposed tools utilised for this investigation. The tools for the study were a modified and personalised form of the CUCEI and three student outcome scales of Satisfaction, Speed and Difficulty.

Chapter 2 contains a review of relevant literature related to past research on learning environments, with emphasis placed on studies involving tertiary classroom environments and the effects of transition from primary to secondary classrooms, as well from secondary to tertiary classrooms. Chapter 2 also contains sections on gender-related differences with regard to student outcomes.

Chapter 3 reports the methodology employed in this study. In this research the original CUCEI was modified and personalised. The modification involved the addition of two new scales, Cooperation and Equity, and the removal of two of the original scales, Involvement and Satisfaction.

The modified and personalised form of the CUCEI was validated and the results of this validation are reported in Chapter 4. Following a factor analysis, five items were deleted from the questionnaire resulting in a final version containing 44 items. Details of the validation for the student and instructor versions are reported in this chapter. The validation data of the three attitudinal scales used in this study were also included in this chapter.

Results of students' and instructors' perceptions at both levels were presented in Chapter 5. A comparison between students' actual and preferred perceptions indicated that students preferred a more positive environment in their classes.

Instructors were also found to have similar expectations in their classrooms, that being a more positive environment. Qualitative data obtained in this study from student and instructor interviews, as well as from classroom observations, were used to complement the findings observed in the quantitative part of the study.

Associations between student perceptions of learning environment and attitudinal outcomes are reported in Chapter 6. The only significant difference in perception with regard to students attitude was seen with respect to the Satisfaction scale, where students were generally dissatisfied with their courses. Students did not perceive any differences in the speed of the courses they were pursuing as they moved from their senior secondary to their post secondary level of studies

This final chapter of this thesis summarises the major findings and implications of this study. In the following sections are a summary of major findings, section 7.3; implications of the study, section 7.4; limitations of the study, section 7.5; possible future research studies, section 7.6; and the final summation, section 7.7.

7.3 Summary of Major Findings

There were eight objectives in this study.

Objective 1:

to develop and validate a personalised form of the College and University Classroom Environment Inventory, (CUCEI).

A growing body of literature has utilised and acknowledged the importance of statistical analysis in the development of classroom environment research instruments (e.g., Fraser & Walberg, 1991, Fraser, 1998). In keeping with past traditions in classroom environment research, the modified form of the CUCEI was validated using a variety of statistical methods (see Chapter 4).

A factor analysis of the 49 item instrument confirmed a seven factor structure for the instrument. The analysis also revealed that five items did not meet the required criteria to remain in the instrument. Thus, the final version of the instrument had 44 items. The instrument was found to have high internal consistency with figures ranging from 0.73 to 0.93 and 0.76 to 0.94 for the actual and preferred versions respectively, using the individual student as the unit of analysis. The instructor version used in this study was also found to have a high reliability with Cronbach alpha coefficients ranging from 0.72 to 0.90 for the actual version and from 0.72 to 0.93 for the preferred version.

The CUCEI was also found to have adequate discriminant validity and appears to measure distinct although somewhat overlapping aspects of the classroom environment, but maintaining distinctions between each scale in each of the seven dimensions in the instrument.

Finally in the validation process the instrument was also found to have the capability of differentiating between the perceptions of students in different classrooms. Using a one-way ANOVA with class membership as the main effect and using the individual as the unit of analysis each CUCEI scale differentiated significantly ($p<0.001$) between classrooms. The eta^2 statistic, which represents the proportion of variance attributable to class membership, ranged from 0.09 to 0.28 for the CUCEI scales.

Objective 2:

to use the modified CUCEI to investigate how students at Northwest Community College and at Senior Secondary Schools differ in their perceptions of their classroom environments.

In Chapter 5, students' perceptions of their classrooms were compared at the two levels of study. The results in Chapter 5 replicated many past research studies in showing that students prefer a more positive classroom environment than that which was present. One such replication was the pattern of greater student cohesiveness at the lower level of studies. This result seems to be at odds to what was expected as the local college intake of students is usually from the local high schools in the region and class sizes at the college are small, and do not exceed 36 students. A possible reason for this result could be that students have become more individualistic in their studies at the post secondary level. Supporting this is the lower mean values reported in the Cooperation scale when students moved to the post secondary level.

Senior secondary students perceived differences between their actual and preferred classroom environment in five of the seven CUCEI scales in comparison to all seven by the post secondary students. The five scales were Personalisation, Student Cohesiveness, Task Orientation, Individualisation and Innovation. Students at both levels perceived the Individualisation scale as the most negative in this study. The results seem to lend support to findings in other studies in that instructors at the higher level do not take into account the differing abilities of their students, students find too many demands on their time and instructors have unrealistically high expectations of their students. One other possible explanation for negative perception of the Individualisation scale at the post secondary level is that students could possibly be relying on their instructors for what they should know before they move on to their second year of studies (which could either be at Northwest or transferring to one of the numerous institutions in British Columbia) and as such do not want too much decision making authority at this level.

Students also perceived at the post secondary and senior secondary levels that they were treated equally in their classrooms as measured by the items in the Equity scale.

Objective 3:

to investigate if the students' gender and age influences their perceptions of their classrooms.

Age did influence students' perceptions of the classroom environment. Mature students only perceived four statistically significant differences between their actual and preferred environments. Both mature and younger students had the same expectations, in that a more positive classroom environment was preferred. The study replicates earlier research work where mature students perceived their classroom more negatively in the areas of individualisation and personalisation (Fraser, Treagust, Williamson, & Tobin, 1987).

Mature students perceived Task Orientation and Equity scales more favourably than the younger students. Fraser, Treagust, Williamson, and Tobin (1987) on the other hand found that adults integrated with adolescents perceived task orientation less favourably. In this study, the more favourable result could be because of the 'guided' approach employed by the instructors at Northwest Community College. Furthermore, the qualitative data indicated that in the classroom observations where instructors employing the 'guided' approach to teaching were observed to give precise instructions and numerous handouts to their students during the lesson.

Generally, male and female students indicated that they preferred a more positive classroom environment than to that which they had at present. However, there were hardly any significant differences in the way males and females perceived their classroom environment. The only difference was seen in the Innovation scale where males perceived this scale more favourably. The similarity in classroom perceptions replicates findings in other studies, that both male and female students perceptions moved closer together as they moved into higher level studies (Ferguson & Fraser, 1996; Fraser 1989; Johnson, 1991).

Objective 4:

to compare how instructors at the college and senior secondary schools perceive their classroom environment.

Instructors at the two levels perceived their classroom environment differently although the pattern was similar to that of the students in that they too preferred a more positive classroom environment. Instructors at the senior secondary level generally perceived their classroom environment more favourably than did post secondary instructors. Post secondary instructors indicated a greater preference than senior secondary instructors to have their students involved in the decision making in their classrooms. One significant difference is seen in the Innovation scale where the college instructors seemed to want greater innovation in their teaching. This suggest that instructors at the college are trying to accommodate the changes expected by the students as they move from one level to the next. This result also adds weight to the innovative approach to teaching in the first semester at the local college termed in this study as the 'guided' approach.

Instructors at the senior secondary level perceived their classroom environment more favourably than did their students. However, this same pattern was not as evident at the post secondary level. A possible explanation could be that at the college level, instructors are more in tune with student preferences and the instructors seem to be accommodating to the needed changes that students undergo in their environment after transition, one such example being the 'guided' approach to teaching their science courses.

Objective 5:

to compare the learning environments of the instructors at Northwest Community College (NWCC) who do and do not employ a 'guided' approach to teaching.

Students perceived the classroom environment of instructors who employed the 'guided' approach of teaching as favourable. Nearly all scales with the exception of the Individualisation scale were unfavourable for the instructor who used the normal mode of teaching, that being lecturing. Students indicated that they would prefer an overhaul in the classroom environment of the instructor who employed the normal mode of teaching. This was indicated by the general high mean scores for nearly all the scales in the preferred version. The results suggest that students' learning environments could be enhanced when instructors at higher levels use a variety of teaching strategies in their classrooms in comparison to just plain lecturing in their science lessons.

Objective 6:

to compare and contrast the degree of difficulty faced by students in their post secondary and senior secondary classrooms.

There were no significant differences in the perceptions of either male or female students with respect to the difficulty level. A possible reason for this could be the way the science classes are taught at the post secondary level. Results in this research revealed that instructors that used the 'guided' approach to teaching were perceived to have a much more favourable classroom environment. One other possible explanation could be that students still view the first semester at Northwest Community College as an extension of their high school and coupled with the 'guided' approach to teaching employed by most instructors at the college, students

could be perceiving a lesser level of difficulty than students that pursue their tertiary work at the larger institutions in British Columbia, Canada.

Objective 7:

to determine the students' perceptions regarding the rate at which the content of the course is covered both at the post secondary and senior secondary levels.

Students at the post secondary level were generally satisfied with the speed of the courses they were taking. No statistically significant differences were observed between the levels with respect to the Speed scale. It seems safe to suggest that students have taken responsibility for their learning and have made adjustments to cope with the increased workload. A further explanation could be related to the innovative teaching techniques that are utilised at the post secondary level at Northwest Community College, that being the 'guided' approach. Results from this study have revealed that the students preferred the innovative approach used in their science classrooms over traditional lecturing methods (Chapter 5, section 5.5).

Objective 8:

to compare associations between the nature of the classroom environment and the attitudes of the students towards their science studies at the college and senior secondary levels.

This was investigated and reported in Chapter Six. Post secondary students perceived three scales which would significantly influence their classroom environment with respect to the attitudinal outcome of Speed. The scales which were significantly related as indicated by the standardised regression weights were Individualisation, Equity and Innovation. The results suggest that as the speed of the courses increases, there is a negative impact on students' perceptions in the items that measure these three scales. However, at the senior secondary level, only one

scale was found to be significantly related with the Speed outcome, namely Individualisation. The trend was similar in that there was an inverse relationship between the Speed outcome and the classroom environment scale of Individualisation.

The same negative relationship was also evident with the attitudinal measure of Difficulty. Post secondary students perceived Student Cohesiveness and Individualisation as the most influential in their classroom in comparison to students in their senior secondary schools. Students at the senior secondary only perceived the Individualisation scale as the most influential.

In the attitudinal outcome of Satisfaction, the classroom environment scales which were significantly related as indicated by the standardised regression weights were observed to have a positive impact on this outcome. Post secondary students perceived that Satisfaction would be increased with greater Student Cohesiveness and Task Orientation, while senior secondary students perceived increased Personalisation, Cooperation and Individualisation would increase the level of Satisfaction in their classrooms.

The results of this comparison show that students at different levels have varying perceptions of their classroom environments that influence their attitudinal outcomes.

7.4 Implications of this Study

7.4.1 *Theoretical*

This study revisits the theoretical under-pinnings and the importance of instruments that have been developed and recognised as important contributors to measuring the classroom learning environment perceptions of students and teachers. As a result, this study makes a number of contributions to the study of learning environments and attitudes.

Firstly, past learning environment studies have shown the importance of student and teacher perceptions as predictors of achievement, behaviour and attitudes. This study makes a distinctive contribution to the learning environment research in that it investigated (i) the classroom environment of both students and teachers simultaneously in their final year of high school and first year of university studies, and (ii) the influence of student attitudes at these levels.

Secondly, previous research has shown that teachers' perceptions of classroom environments frequently differ from their students' perceptions and that the perception of students is a more reliable indicators of learning outcomes (Fraser, 1994). This study replicated findings from previous studies in that both students and teachers have differing perceptions of their classrooms. This study provides further empirical support for the observed differences.

Thirdly, in order to provide a better means of research in the classroom environment in higher education settings, the modified and personalised CUCEI was developed. The scales of the instrument retained five of the original seven scales and added two new scales, namely the Equity and Cooperation scales. The scales of this instrument, drawn from two instruments, the original CUCEI and the WIHIC, were found to display adequate validity, internal consistency reliability, and discriminant validity. Each scale in the instrument was also found to differentiate between the perceptions of students in different classrooms.

Fourth, recent studies in the learning environments have revealed that personalised measurements yield greater feedback from the participants than instruments which were based on students perceptions of their classes as a whole (e.g., Fraser, Fisher, & McRobbie, 1996; Fraser & McRobbie, 1995). The primary modification in this study focused on personalising the instrument. The findings replicated previous research work and provided further empirical support for classroom environment research to be carried out utilising the personal form of measurement.

Fifth, this is the first study to use the modified and personalised form of the CUCEI both in Canada and Australia. Significantly, the instrument has been shown to be reliable in two different educational settings.

Sixth, this research makes a valuable contribution in directly researching the classroom environments of instructors who employ the 'guided' approach to teaching provided in the science program at Northwest Community College. The study provides evidence to the other instructors in the college and university instructors in general that a 'guided' or innovative approach to teaching in a higher level setting leads students to better understand the real expectations of university study, resulting in greater learning in the sciences. This is supported by the more favourable perceptions of students of their science classroom environments which had the innovative teaching approach. Further, students have indicated during the classroom observations that they could follow and contribute to the lessons. Instructors have also indicated that the use of the innovative approach in their classes has resulted in many of their students going on to larger institutions to complete their degrees.

Seventh, the study also viewed the perceptions of students based on their gender. Significantly, it replicated findings and provided further empirical support for the assertion that male and female students' perceptions of their classrooms moved closer together as they moved to higher level of studies.

Eighth, while traditional classrooms at the post secondary level have been usually dominated by students fresh from the high schools, the nature of the classrooms in recent years have undergone a transformation as more adults return to further their studies (Chang, 1999; Rollnick & Manyatsi, 1997). This study makes a valuable contribution to classroom environment research as the diversity of perceptions between mature and younger students at the post secondary level were investigated.

Ninth, the literature indicates that students face greater difficulty and a faster pace in the delivery of their lessons in their courses when they move to a higher level of study. However, this research showed that with the innovative approaches used by instructors at Northwest Community College, both these factors were found by students as not being significant. Importantly, this study provides empirical support for the viability of innovative approaches to improve the learning environment at post secondary levels.

Tenth, the level of satisfaction in the classroom has been to found to be positively influenced by classroom environments. This research replicated findings from previous studies and provides further empirical support for this factor.

Eleventh, researchers over the last few decades have placed greater emphasis on either forms of research, quantitative or qualitative. However, in recent times there has been a move towards complementing quantitative research with qualitative approaches. Significantly, this study provides further support in showing the value of having both quantitative and qualitative work.

Finally, while there is a substantial body of literature on classroom learning environments at the primary and secondary level, there has been relatively little research on the learning environments of post secondary classrooms. The study helps not only to fill this gap but also provides the basis for further classroom environment research at the post secondary level.

7.4.2 *Practical*

This study confirmed the 44-item version of *the College and Universities Classroom Environment Inventory (CUCEI)* as a valid, reliable and economical instrument for use in learning about the classroom environment at the senior and post secondary levels. Instructors could find the CUCEI to be a valuable source of information, particularly for comparisons between their own and their students' perceptions. The study also demonstrated that instructors at different levels could gain an insight to

the perceptions of their colleagues and possibly use the information to aid teaching and learning in their classrooms. The instrument has also been shown to be sensitive to the teaching approaches instructors use in their classroom. Studies have indicated that student perceptions of their classroom and instructor perceptions of their own classroom to be reliable indicators that can be utilised for improving teaching and learning (e.g., Fraser, 1986, 1991, 1994, 1998; Fraser & Fisher, 1994; Suarez, Pias, Membiela, & Dapia, 1998; Villar, 1995; Yarrow, Millwater, & Fraser, 1997). The existence of the preferred form of the instrument also provides a possible approach to instructors in improving classrooms. This can be achieved by employing the person-environment fit approach which is to alter or vary the classroom environment more toward the preferred environment of their students with a view to improving the classroom environment and the learning of sciences.

7.5 Limitations of the Study

Although this study was successful in showing perception differences between post and senior secondary students and instructors, the study was limited in the following ways.

First, though qualitative information provides valuable information and insight and added a further dimension to this study, the number of students interviewed was small and all were at the post secondary level. This limits the applicability of their comments to the general student population.

The quantitative data used in this study for the comparison of perceptions were small (130 post secondary students) and this is the second limitation in this study. A higher population would have given better rigour to the study.

Third, data were collected in first year introductory classes, which means that most students in the study had limited exposure to higher education. This limits the

perception of students as most of the sample in this study came from the local high schools in the region.

Finally, data were confined to a community college offering university courses. The environments experienced by the students are varied as there are students on campus not only taking university courses but, taking vocational courses, professional courses and adult education courses.

7.6 Possible Future Research Studies

The major purpose of this thesis was to investigate the students' and instructors' perceptions of their learning environment and students' attitudinal outcomes. The study is unique in that it utilises the modified and personalised form of the CUCEI. To throw further light on the study involving perceptions of senior and post secondary students and instructors, the following are some desirable and new directions that could prove worthwhile:

- Person-environment fit research to investigate whether students achieve better, cognitively and affectively, when there is a better match between their actual and preferred classroom environment. An example of such a study was reported by Fraser and Fisher (1983a).

- Using a larger qualitative component so that it would be more representative of the student population. Further, interviews and observations should be undertaken at both senior secondary and post secondary levels of education.

- Cross validating the modified instrument in various countries to reinforce the validity of the questionnaire.

- Incorporating the classroom environment into the instructor professional development programs both at the senior and post secondary levels. In fact, Fisher and Fraser (1991) reported a similar study.

- Examination of the relationship between instructors' and students' perceived classroom environment both actual and preferred, and their interpersonal behaviour.

- Researching the impact of computers in the science classroom environment at the tertiary level. Most institutions have incorporated cyberspace in their classroom work and this has impacted on the way science is taught and learnt in universities.

- Examination of the classroom and laboratory perceptions of students and instructors at the tertiary level. This would add a dimension to research in science education as it could throw some light on the connection between the laboratory and the classroom at higher education levels.

- A comparative environmental study using the modified CUCEI involving university science classes at the community colleges and university. This would help determine the size and type of the institution and the size of classes have differing effects on the classroom environment. An example of a similar study was reported by Vahala and Winston (1994).

7.7 Final Summation

This thesis commenced by pointing out that students have in general found the transition from the senior secondary schools to the post secondary system to be problematic. Often the reasons for the problems experienced have been associated with the shift of blame either to the students or instructors. This study approached this problematic issue by investigating the actual and preferred perceptions of

students and instructors in the final year of their high school going on to their first semester of their post secondary education. Using the theory that teachers' perceptions of classroom environments frequently differ from their students' perceptions and that the perceptions of students are more reliable indicators of learning outcomes, the research investigated the actual and preferred perceptions of students and instructors at both levels of education. The study also indicates what contributes to positive attitudes amongst the students in their classrooms. The findings in this thesis have important practical applications to educators in general as they provide feedback that could aid in the promotion of positive attitudes, classroom environments and teaching styles in the class, thus resulting in improved teaching and learning in the sciences. The instrument developed in this study has been shown to be sensitive enough to pick up subtle differences in teaching styles employed by different instructors as well as the perceptions of students in different classes.

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APPENDICES

APPENDIX A

College & University Classroom Environment Inventory (CUCEI)

Personalised Form

Actual (Student) version

Directions

This questionnaire contains statements about practices which could take place in this class. You will be asked how often each practice takes place. There are no **'right' or 'wrong'** answers. Your opinion is what is wanted. Think about how well each statement describes what this class is like for you.

Draw a circle around

1	if the practice takes place	**Almost Never**
2	if the practice takes place	**Seldom**
3	if the practice takes place	**Sometimes**
4	if the practice takes place	**Often**
5	if the practice takes place	**Almost Always**

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

Some statements in this questionnaire are fairly similar to other statements. Don't worry about this. Simply give your opinion about all statements.

All opinions and information supplied will be treated in strict confidence. No particulars will be released for any reason. All information is to be used for research only.

Statistical Information

Class: (eg. Chemistry 12, Physics 12, Chem 101, etc.)_____ Student's Sex: Male Female

What was your grade on the last test (AB, C, D, E, F)_____ Age: _____

Teachers Name (Optional): _____

	Remember that you are describing your **actual** *classroom*	Almost Never	Seldom	Some-times	Often	Almost Always
1	The instructor considers my feelings.	1	2	3	4	5
2	The instructor is friendly and talks to me.	1	2	3	4	5
3	The instructor goes out of his/her way to help me.	1	2	3	4	5
4	The instructor helps me when I am having trouble with my work.	1	2	3	4	5
5	The instructor moves around the classroom to talk with me.	1	2	3	4	5
6	The instructor is interested in my problems.	1	2	3	4	5
7	The instructor is unfriendly and inconsiderate towards me.	1	2	3	4	5
8	New ideas are seldom tried out in this class.	1	2	3	4	5
9	My instructor uses new and different ways of teaching in this class.	1	2	3	4	5
10	The instructor thinks up innovative activities for me to do.	1	2	3	4	5
11	The teaching approaches used in this class are characterized by innovation and variety.	1	2	3	4	5
12	Seating in this class is arranged in the same way each week.	1	2	3	4	5
13	The instructor often thinks of unusual activities.	1	2	3	4	5
14	I seem to do the same type of activities in every class.	1	2	3	4	5
15	My class is made up of individuals who don't know each other well.	1	2	3	4	5
16	I know most students in this class by their first names.	1	2	3	4	5
17	I make friends easily in this class.	1	2	3	4	5
18	I don't get much of a chance to know my classmates.	1	2	3	4	5
19	It takes me a long time to get to know everybody by his/her first name in this class.	1	2	3	4	5
20	I have the chance to know my classmates well.	1	2	3	4	5
21	I am not very interested in getting to know other students in this class.	1	2	3	4	5
22	I know exactly what has to be done in this class.	1	2	3	4	5
23	I find getting a certain amount of work done is important in this class.	1	2	3	4	5
24	I often get sidetracked in this class instead of sticking to the point.	1	2	3	4	5
25	This class is always disorganised.	1	2	3	4	5
26	Class assignments are clear and I know what to do.	1	2	3	4	5
27	This class seldom starts on time.	1	2	3	4	5
28	Activities in this class are clearly & carefully planned.	1	2	3	4	5

Please turn over →

	Remember that you are describing your ***actual*** *classroom*	**Almost Never**	**Seldom**	**Some-times**	**often**	**Almost Always**
29	I cooperate with other students when doing assignment work.	1	2	3	4	5
30	I share my books and resources with other students when doing assignments.	1	2	3	4	5
31	I work with other students on projects in this class.	1	2	3	4	5
32	I learn from other students in this class.	1	2	3	4	5
33	I work with other students in this class.	1	2	3	4	5
34	I cooperate with other students on class activities.	1	2	3	4	5
35	Students work with me to achieve class goals.	1	2	3	4	5
36	I am expected to do the same work as all the students in the class, in the same way and in the same time.	1	2	3	4	5
37	I am generally allowed to work at my own pace in this class.	1	2	3	4	5
38	I have a say in how class time is spent.	1	2	3	4	5
39	I am allowed to choose activities and how I will work.	1	2	3	4	5
40	Teaching approaches in this class allow me to proceed at my own pace.	1	2	3	4	5
41	I have little opportunity to pursue my particular interests in this class.	1	2	3	4	5
42	My instructor decides what I will do in this class.	1	2	3	4	5
43	The instructor gives as much attention to my questions as to other students questions.	1	2	3	4	5
44	I get the same amount of help from the instructor as do other students.	1	2	3	4	5
45	I am treated the same as other students in this class.	1	2	3	4	5
46	I receive the same encouragement from the instructor as other students do.	1	2	3	4	5
47	I get the same opportunity to answer questions as other students.	1	2	3	4	5
48	My work receives as much praise as other students work.	1	2	3	4	5
49	I have the same amount of say in this class as other students.	1	2	3	4	5

Please turn over ➜

Part B

Directions

For the following statements indicate your opinion about each questionnaire statement by circling a number; 1, 2, 3, or 4. Each number corresponds to the degree of agreement to the statements in the questionnaire.

Remember, each statement describes what this class is like for your

Each number in the scale corresponds to the following:

If you **STRONGLY AGREE** with the statement circle number	4
If you **AGREE** with the statement circle number	3
If you **DISAGREE** with the statement circle number	2
If you **STRONGLY DISAGREE** with the statement circle number	1

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

	Remember that you are describing your **actual** *classroom*	Strongly Disagree	Disagree	Agree	Strongly Agree
1	I look forward to coming to class.	1	2	3	4
2	I am dissatisfied with what is done in this class.	1	2	3	4
3	At the end of each class, I have a sense of satisfaction.	1	2	3	4
4	The class I have is a waste of time.	1	2	3	4
5	This class is boring.	1	2	3	4
6	I enjoy going to this class.	1	2	3	4
7	My classes are interesting.	1	2	3	4
8	I find the work in this class difficult.	1	2	3	4
9	I am constantly challenged in this class.	1	2	3	4
10	I find the subject studies requires no particular aptitude.	1	2	3	4
11	The work in this class tends to be hard.	1	2	3	4
12	I find the subject presentation in this class too elementary.	1	2	3	4
13	I consider the subject matter easy.	1	2	3	4
14	I have difficulty doing the required advanced work in this class.	1	2	3	4

Please turn over →

	Remember that you are describing your **actual** *classroom*	**Strongly Disagree**	**Disagree**	**Agree**	**Strongly Agree**
15	The pace in this class is rushed.	1	2	3	4
16	I have plenty of time to cover the prescribed amount of work.	1	2	3	4
17	I have no need to hurry to finish my work in this class.	1	2	3	4
18	There is little time for day-dreaming in this class.	1	2	3	4
19	In this class, I feel rushed to finish my work.	1	2	3	4
20	I have difficulty keeping up with the assigned work.	1	2	3	4
21	I find the course material is covered too quickly.	1	2	3	4

Note: All opinions and information supplied will be treated in strict confidence. No particulars will be released for any reason. All information is to be used for research only.

Thank you for your time and cooperation

APPENDIX B

College & University Classroom Environment Inventory (CUCEI)

Personalised Form

Preferred (Student) version

Directions

This questionnaire contains statements about practices which could take place in this class. You will be asked how well each statement describes what you would *like* or *prefer* your class to be like. There are no 'right' or 'wrong' answers. Your opinion is what is wanted.

Think about how well each statement describes what you would prefer this class to be like.

Draw a circle around

1	if you would prefer the practice to take place	**Almost Never**
2	if you would prefer the practice to take place	**Seldom**
3	if you would prefer the practice to take place	**Sometimes**
4	if you would prefer the practice to take place	**Often**
5	if you would prefer the practice to take place	**Almost Always**

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

Some statements in this questionnaire are fairly similar to other statements. Don't worry about this. Simply give your opinion about all statements.

All opinions and information supplied will be treated in strict confidence. No particul ars will be released for any reason. All information is to be used for research only.

Statistical Information

Class: (eg. Chemistry 12, Physics 12, Chem 101, etc.)_____ Student's Sex: Male Female

What was your grade on the last test (AB, C, D, E, F)_____ Age: _____

Teachers Name (Optional): _____

	Remember that you are describing your **ideal** *classroom*	**Almost Never**	**Seldom**	**Some-times**	**Often**	**Almost Always**
1	The instructor would consider my feelings.	1	2	3	4	5
2	The instructor would be friendly and would talk to me.	1	2	3	4	5
3	The instructor would go out of his/her way to help me.	1	2	3	4	5
4	The instructor would help me when I am having trouble with my work	1	2	3	4	5
5	The instructor would move around the classroom to talk with me.	1	2	3	4	5
6	The instructor would be interested in my problems.	1	2	3	4	5
7	The instructor would be unfriendly and inconsiderate towards me.	1	2	3	4	5
8	New ideas would be seldom tried out in the class	1	2	3	4	5
9	My instructor would use new and different ways of teaching in the class.	1	2	3	4	5
10	The instructor would think up innovative activities for me to do.	1	2	3	4	5
11	The teaching approaches used in the class would be characterized by innovation and variety.	1	2	3	4	5
12	Seating in the class would be arranged in the same way each week.	1	2	3	4	5
13	The instructor would often think of unusual activities	1	2	3	4	5
14	I would do the same type of activities in every class.	1	2	3	4	5
15	My class would be made up of individuals who did not know each other well.	1	2	3	4	5
17	I would make friends easily in the class.	1	2	3	4	5
18	I would not get much of a chance to know my classmates.	1	2	3	4	5
19	I would take a long time to get to know everyone in my class by his/her first name in the class.	1	2	3	4	5
20	I would have the chance to know my classmates well.	1	2	3	4	5
21	I would not be very interested in getting to know other students in the class.	1	2	3	4	5
22	I would know exactly what had to be done in the class.	1	2	3	4	5
23	Getting a certain amount of work done would be important in the class.	1	2	3	4	5
24	I would often get sidetracked in the class instead of sticking to the point	1	2	3	4	5
25	The class would be always disorganized.	1	2	3	4	5
26	Class assignments would be clear and I would know what to do.	1	2	3	4	5
27	The class would seldom start on time	1	2	3	4	5
28	Activities in the class would be clearly & carefully planned.	1	2	3	4	5

Please turn over ➜

	Remember that you are describing your **ideal** *classroom*	**Almost Never**	**Seldom**	**Some-times**	**Often**	**Almost Always**
29	I would cooperate with other students in my class when doing assignment work.	1	2	3	4	5
30	I would share my books and resources with other students when doing assignments	1	2	3	4	5
31	I would work with other students on projects in the class.	1	2	3	4	5
32	I would learn from other students in the class.	1	2	3	4	5
33	I would work with other students in the class	1	2	3	4	5
34	I would cooperate with other students in my class on class activities	1	2	3	4	5
35	Students would work with me to achieve class goals	1	2	3	4	5
36	I would be expected to do the same work as all the students in the class, in the same way and in the same time.	1	2	3	4	5
37	I would generally be allowed to work at my own pace in the class.	1	2	3	4	5
38	I would have a say in how class time is spent.	1	2	3	4	5
39	I would be allowed to choose activities and how I would work.	1	2	3	4	5
40	Teaching approaches in this class would allow me to proceed at my own place	1	2	3	4	5
41	I would have little opportunity to pursue my particular interests in the class	1	2	3	4	5
42	My instructor decides what I would do in this class.					
43	The instructor would give as much attention to my questions as to other students' questions.	1	2	3	4	5
44	I would get the same amount of help from the instructor as do other students.	1	2	3	4	5
45	I would be treated the same as other students in the class	1	2	3	4	5
46	I would receive the same encouragement from the instructor as other students do.	1	2	3	4	5
47	I would get the same opportunity to answer questions as other students do.	1	2	3	4	5
48	My work would receive as much praise as other students work.	1	2	3	4	5
49	I would have the same amount of say in the class as other students.	1	2	3	4	5

Note: All opinions and information supplied will be treated in strict confidence. No particulars will be released for any reason. All information is to be used

Thank you for your time and cooperation

APPENDIX C

College & University Classroom Environment Inventory (CUCEI)

Personalised Form

Instructor Actual version

Directions

This questionnaire contains statements about practices which could take place in this class. You will be asked how well each statement describes what you would *like* or *prefer* your class to be like. There are no 'right' or 'wrong' answers. Your opinion is what is wanted. Think about how well each statement describes what you would prefer this class to be like.

Draw a circle around

1	if you would prefer the practice to take place	**Almost Never**
2	if you would prefer the practice to take place	**Seldom**
3	if you would prefer the practice to take place	**Sometimes**
4	if you would prefer the practice to take place	**Often**
5	if you would prefer the practice to take place	**Almost Always**

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

Some statements in this questionnaire are fairly similar to other statements. Don't worry about this. Simply give your opinion about all statements.

Note: All opinions and information supplied will be treated in strict confidence. No particulars will be released for any reason. All information is to be used for research only.

Statistical Information

Teachers Name: _____ Class (e.g. Chemisty 12, Chem 101, etc.) _____

Sex: ___Male ____Female Age: _____ No. of years teaching: _____

	Remember that you are describing your **actual** *classroom*	**Almost Never**	**Seldom**	**Some-times**	**Often**	**Almost Always**
1	I consider my students feelings.	1	2	3	4	5
2	I am friendly towards my students and talk to them.	1	2	3	4	5
3	I go out of my way to help my students.	1	2	3	4	5
4	I help my students when they have trouble with their work.	1	2	3	4	5
5	I seldom move around the classroom to talk with my students.	1	2	3	4	5
6	I am interested in my students problem.	1	2	3	4	5
7	I am unfriendly and inconsiderate towards my students.	1	2	3	4	5
8	I seldom try out new ideas in this class.	1	2	3	4	5
9	I seldom use new and different ways of teaching in this class.	1	2	3	4	5
10	I think up innovative activities for students to do.	1	2	3	4	5
11	The teaching approaches I use in this class are characterized by innovation and variety.	1	2	3	4	5
12	Seating in this class is arranged in the same way each week.	1	2	3	4	5
13	I often think of unusual activities in this class	1	2	3	4	5
14	I seem to have the same type of activities in every class.	1	2	3	4	5
15	My class is made up of individuals who don't know each other well.	1	2	3	4	5
16	Students in my class know one another by their first names.	1	2	3	4	5
17	Students make friends easily in my class.	1	2	3	4	5
18	Students in my class don't get much of a chance to know their classmates.	1	2	3	4	5
19	Students in my class take a long time to get to know everybody by his/her first name in this class.	1	2	3	4	5
20	Students in my class have the chance to know their classmates well.	1	2	3	4	5
21	Students in my class are not very interested in getting to know all their classmates.	1	2	3	4	5
22	Students in my class know exactly what has to be done in this class.	1	2	3	4	5
23	Students find getting a certain amount of work done is important in this class.	1	2	3	4	5
24	Students often get sidetracked in this class instead of sticking to the point.	1	2	3	4	5
25	My class is always disorganised.	1	2	3	4	5
26	My class assignments are clear and my students know what to do.	1	2	3	4	5
27	My class seldom starts on time.	1	2	3	4	5
28	I plan the activities in this class, clearly & carefully.	1	2	3	4	5

Please Turn Over

	Remember that you are describing your **actual** *classroom*	**Almost Never**	**Seldom**	**Some-times**	**Often**	**Almost Always**
29	Students in my class cooperate with each other when doing assignment work.	1	2	3	4	5
30	Students in this class share their books and resources with other students when doing assignments.	1	2	3	4	5
31	Students work with other students on projects in this class.	1	2	3	4	5
32	Students in my class learn from each other in this class.	1	2	3	4	5
33	Each student works with other students in this class.	1	2	3	4	5
34	Students in this class cooperate on class activities.	1	2	3	4	5
35	Students work with each other to achieve class goals.	1	2	3	4	5
36	I expect all my students in the class to do the same work, in the same way and in the same time.	1	2	3	4	5
37	I generally allow my students to work at their own pace in this class.	1	2	3	4	5
38	Students in this class have a say in how class time is spent.	1	2	3	4	5
39	I allow my students to choose activities and how they will work.	1	2	3	4	5
40	The teaching approaches I use in this class allow my students to proceed at their own pace.	1	2	3	4	5
41	Students in my class have little opportunity to pursue their particular interests in this class.	1	2	3	4	5
42	I decide what will be done in this class.	1	2	3	4	5
43	I give equal attention to all the students questions.	1	2	3	4	5
44	I give the same amount of help to all my students.	1	2	3	4	5
45	I treat all students in this class the same.	1	2	3	4	5
46	I give the same encouragement to all my students.	1	2	3	4	5
47	All my students get the same opportunity to answer questions.	1	2	3	4	5
48	I give equal praise to all my students when required.	1	2	3	4	5
49	All my students have the same amount of say in this class.	1	2	3	4	5

Note: All opinions and information supplied will be treated in strict confidence. No particulars will be released for any reason. All information is to be used for research only.

Thank you for your time and cooperation

APPENDIX D

College & University Classroom Environment Inventory (CUCEI)

Personalised Form

Instructor Preferred version

Directions

This questionnaire contains statements about practices which could take place in this class. You will be asked how well each statement describes what you would *like* or *prefer* your class to be like. There are no 'right' or 'wrong' answers. Your opinion is what is wanted. Think about how well each statement describes what you would prefer this class to be like.

Draw a circle around

1	if you would prefer the practice to take place	**Almost Never**
2	if you would prefer the practice to take place	**Seldom**
3	if you would prefer the practice to take place	**Sometimes**
4	if you would prefer the practice to take place	**Often**
5	if you would prefer the practice to take place	**Almost Always**

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

Some statements in this questionnaire are fairly similar to other statements. Don't worry about this. Simply give your opinion about all statements.

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Statistical Information

Teachers Name: _____ Class (e.g. Chemisty 12, Chem 101, etc.) _____

Sex: ___Male ____Female Age: _____ No. of years teaching: _____

	Remember that you are describing your **ideal** *classroom*	**Almost Never**	**Seldom**	**Some-times**	**Often**	**Almost Always**
1	I would consider my students' feelings	1	2	3	4	5
2	I would be friendly towards my students and talk to them	1	2	3	4	5
3	I would go out of my way to help my students	1	2	3	4	5
4	I would help my students when they have trouble with their work	1	2	3	4	5
5	I would move around the classroom to talk with my students	1	2	3	4	5
6	I would be interested in my students problems	1	2	3	4	5
7	I would be unfriendly and inconsiderate towards my students.	1	2	3	4	5
8	I would seldom try out new ideas in the class	1	2	3	4	5
9	I would seldom use new and different ways of teaching in the class.	1	2	3	4	5
10	I would think up innovative activities for students to do.	1	2	3	4	5
11	The teaching approaches I would use in the class would be characterized by innovation and variety.	1	2	3	4	5
12	Seating in this class would be arranged in the same way each week.	1	2	3	4	5
13	I would often think of unusual activities in this class	1	2	3	4	5
14	I would have the same type of activities in every class.	1	2	3	4	5
15	My class is made up of individuals who would not know each other well	1	2	3	4	5
16	Students in my class would know one another by their first names	1	2	3	4	5
17	Students would make friends easily in my class	1	2	3	4	5
18	Students in my class would not get much of a chance to know their classmates	1	2	3	4	5
19	Students in my class would take a long time to get to know everybody by his/her first name	1	2	3	4	5
20	Students in my class would have the chance to know their classmates well	1	2	3	4	5
21	Students in my class would not be very interested in getting to know all their classmates.	1	2	3	4	5

Please Turn Over

	Remember that you are describing your **ideal** *classroom*	**Almost Never**	**Seldom**	**Some-times**	**Often**	**Almost Always**
22	Students in my class would know exactly what has to be done in this class	1	2	3	4	5
23	Students would find getting a certain amount of work done is important in this class.	1	2	3	4	5
24	Students would often get sidetracked in this class instead of sticking to the point.	1	2	3	4	5
25	My class would always be disorganised.		2	3	4	5
26	My class assignments would be clear and my students would know what to do.	1	2	3	4	5
27	My class would seldom start on time	1	2	3	4	5
28	I would plan the activities in the class, clearly & carefully	1	2	3	4	5
29	Students in my class would cooperate with each other when doing assignment work.	1	2	3	4	5
30	other students when doing assignments.	1	2	3	4	5
31	Students would work with other students on projects in this class.	1	2	3	4	5
32	Students in my class would learn from each other.	1	2	3	4	5
33	Each student would work with other students in the class	1	2	3	4	5
34	Students in the class would cooperate on class activities	1	2	3	4	5
35	Students would work with each other to achieve class goals	1	2	3	4	5
36	I would expect all my students in the class to do the same work, in the same way and in the same time.	1	2	3	4	5
37	I would generally allow my students to work at their own pace in this class	1	2	3	4	5
38	Students in this class would have a say in how class time is spent.	1	2	3	4	5
39	I would allow my students to choose activities and how they will work	1	2	3	4	5
40	The teaching approaches I use in this class would allow my students to proceed at their own pace.	1	2	3	4	5
41	Students in my class would have little opportunity to pursue their particular interests in this class.	1	2	3	4	5
42	I would decide what will be done in this class.	1	2	3	4	5
43	I would give equal attention to all the students questions	1	2	3	4	5
44	I would give the same amount of help to all my students.	1	2	3	4	5
45	I would treat all students in this class the same.	1	2	3	4	5
46	I would give the same encouragement to all my students	1	2	3	4	5
47	All my students would get the same opportunity to answer questions.	1	2	3	4	5
48	I would give equal praise to all my students when required.	1	2	3	4	5
49	All my students would have the same amount of say in the class	1	2	3	4	5

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Thank you for your time and cooperation