

Science and Mathematics Education Centre

**Teacher-Student Interactions and
Science Classroom Learning Environments in India**

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ABSTRACT

The research reported in this thesis is an in-depth study of teacher-student interactions and science classroom learning environments in Jammu, India. Jammu city is the winter capital of the state of Jammu and Kashmir, situated at the extreme north of India. This is the first time that any learning environment research has been conducted and reported from this part of the world.

The objective of this research was to provide further validation information about two already existing learning environment instruments with Indian students and describe, discuss and analyse information on the associations between students' perceptions of learning environment and their attitudes and cognitive achievements. Differences in the perceptions of different groups namely gender, religious and cultural were also investigated.

The present study commenced with a more positivistic framework, with an aim of providing a large-scale quantitative overview. The *Questionnaire on Teacher Interaction* (QTI), the *What is Happening in this Class?* (WIHIC) and an *Attitude Scale* were administered to 1,021 students from 32 science classes in seven different co-educational private schools in Jammu.

The data were analysed to determine the reliability, validity and mean of each scale. Students were interviewed to determine further the reliability of the questionnaires, in addition to providing information that might explain the QTI and WIHIC mean scale scores. As a result of critical reflection, the study moved towards a more interpretative framework, drawing on elements of the constructivist and critical theory paradigms. Multiple research methods were used to member and deepen the researchers' understanding of the learning environments in Jammu. An educational critique was used to describe the social and cultural factors that could influence the prevailing learning environments .

DECLARATION

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

Signed.....

Rekha B Koul

Date:

THIS THESIS IS DEDICATED TO

MY MOTHER

SHEELA BHAN

A true guide, inspiring friend and a dedicated mother, who till the end
believed in the value of education.

ACKNOWLEDGEMENTS

As I reach the end of my research journey, I look back and with immense pleasure and satisfaction realise the vast range of learning experiences encountered. During this journey I came in contact with many people from different parts of the world that guided, inspired and challenged me in my professional growth. I am thankful to all of them.

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TABLE OF CONTENTS

Abstract	i
Declaration	ii
Acknowledgements	v
List of Figures	xiii
List of Tables	xv
Appendices	xviii

CHAPTER ONE INTRODUCTION

1.1 BACKGROUND	1
1.2 CONCEPTUAL FRAMEWORK	3
1.3 THEORETICAL FRAMEWORK	5
1.4 OBJECTIVES OF THE STUDY	8
1.5 SIGNIFICANCE OF THE STUDY	9
1.6 LIMITATIONS OF THE STUDY	10
1.7 EDUCATION IN INDIA	11
1.7.1 Background	11
1.7.2 National Policy on Education	12
1.7 OVERVIEW OF THE THESIS	14
1.9 CHAPTER SUMMARY	16

CHAPTER TWO LITERATURE REVIEW

2.1 INTRODUCTION	17
2.2 INTRODUCTION TO RESEARCH ON LEARNING ENVIRONMENTS	18
2.3 THE DEVELOPMENT OF LEARNING ENVIRONMENT INSTRUMENTS	21

2.3.1 Actual and Preferred Forms	28
2.3.2 Short and Long Forms of the CES, ICEQ and MCI	28
2.4 THE STUDY OF PERCEPTIONS OF CLASSROOM LEARNING ENVIRONMENTS	29
2.4.1 Development of ‘What is Happening in this Class (WIHIC) Questionnaire’	29
2.4.2 Review of Literature on Perceptions of Classroom Environment	31
2.5 STUDY OF TEACHER STUDENT INTERACTION	42
2.5.1 Historical Background	42
2.5.2 The Development of the Model for Interpersonal Teacher Behaviour	47
2.5.3 The Development of the Questionnaire on Teacher Interaction (QTI)	49
2.5.4 Review of Literature on Student Teacher Interactions	54
2.6 STUDENT ATTITUDES	67
2.6.1 Definition of Student Attitudes	68
2.6.2 Evaluation of Student Attitudes	69
2.7 CHAPTER SUMMARY	69
CHAPTER THREE RESEARCH METHODS	
3.1 INTRODUCTION	71
3.2 PREPARATION FOR THE STUDY	72
3.3 GATHERING THE DATA	73
3.3.1 First Encounter	73
3.4 SURVEY DATA COLLECTION	74
3.4.1 The Instruments Used for Data Collection	75
3.4.2 Pre-testing of the Questionnaires	76
3.4.3 Survey Data Collection for the Main Study	76
3.5 QUANTITATIVE DATA ANALYSIS	77
3.6 CLASSROOM OBSERVATIONS	79
3.6.1 Selection of the Settings	79
3.6.2 Recording the Observations	80
3.6.3 Representing the Observations	81
3.7 INTERVIEWS	82
3.7.1 Student Interviews	82
3.7.2 Teacher Interviews	83

3.8 RESEARCHER’S STORIES	84
3.8.1 Representation of Stories	84
3.8.2 Interpreting the Stories	85
3.9 CHAPTER SUMMARY	85
CHAPTER FOUR VALIDATION AND DESCRIPTIVE INFORMATION FOR THE QTI AND THE WIHC	
4.1 INTRODUCTION	87
4.2 VALIDATION OF THE QTI	88
4.3 VALIDATION OF THE WIHC	96
4.4 VALIDATION OF THE ATTITUDE SCALE	101
4.5 CHAPTER SUMMARY	102
CHAPTER FIVE ANALYSIS AND RESULTS FROM THE QUANTITATIVE DATA	
5.1 INTRODUCTION	103
5.2. ATTITUDES	
5.2.1 Associations between Teacher-Student Interactions and Attitude towards Science Class	104
5.2.2 Associations between Classroom Environment and Attitudes towards Science Class	105
5.3 GENDER DIFFERENCES	
5.3.1 Teacher-Student Interactions and Gender Differences	108
5.3.2 Perceptions of Learning Environments and Gender Differences	110
5.4 CULTURAL DIFFERENCES	
5.4.1 Associations between Teacher-Student Interaction and Cultural Group of the Student	113
5.4.2 Associations between Classroom Environment and Culture of the Students	116
5.5 RELIGIOUS DIFFERENCES	
5.5.1. Associations between Student-Teacher Interactions and Religion of the Students	118
5.5.2 Associations between Learning Environments and Religious Differences	120

5.6 COGNITIVE ACHIEVEMENT	
5.6.1 Associations Between Student-Teacher Interactions and the Cognitive Achievement of the Student.	121
5.6.2 Associations Between Classroom Learning Environment and the Cognitive Achievement of the Student.	123
5.7 CHAPTER SUMMARY	124

CHAPTER SIX STUDENT INTERVIEWS

6.1 INTRODUCTION	126
6.2 CONSTRUCT VALIDATION OF THE QTI SCALES	
6.2.1 The Leadership scale	128
6.2.2 The Helping/Friendly scale	131
6.2.3 The Understanding scale	134
6.2.4 The Student Responsibility and Freedom scale	136
6.2.5 The Uncertain scale	138
6.2.6 The Dissatisfied scale	140
6.2.7 The Admonishing scale	142
6.2.8 The Strict scale	144
6.3 CONSTRUCT VALIDATION OF THE WIHIC SCALES	
6.3.1 The Student Cohesiveness Scale	147
6.3.2 The Teacher Support Scale	148
6.3.3 The Involvement Scale	150
6.3.4 The Investigation Scale	151
6.3.5 The Task Orientation Scale	153
6.3.6 The Cooperation Scale	154
6.3.7 The Equity Scale	155
6.4 CONSTRUCT VALIDATION OF THE ATTITUDE SCALE	
6.4.1 The Attitude Scale	158
6.5 CHAPTER SUMMARY	159

CHAPTER SEVEN CLASSROOM OBSERVATIONS

7.1 INTRODUCTION	161
7.2 EDUCATIONAL CRITICISM	163
7.3 LIFE OUTSIDE THE CLASSROOM	165
7.3.1 Story 1. Life outside classroom	165

7.4 LIFE IN THE CLASSROOM	171
7.4.1 Story 2. A Science Theory Classroom	171
7.4.2 Story 3: A Science Practical Class	176
7.5 DISCUSSION	181
7.5.1 Status of Teacher	182
7.5.2 Examination Dominated Curriculum	184
7.5.3 Effect of Political Unrest	188
7.6 CHAPTER SUMMARY	189
CHAPTER EIGHT CONCLUSIONS, LIMITATIONS AND FUTURE DIRECTIONS	
8.1 INTRODUCTION	190
8.2 OVERVIEW OF THE RESEARCH DESIGN	191
8.3 MAJOR FINDINGS OF THE STUDY	192
8.3.1 Research Objective 1	192
8.3.2 Research Objective 2	194
8.3.3 Research Objective 3	195
8.3.4 Research Objective 4	195
8.3.5 Research Objective 5	196
8.3.6 Research Objective 6	196
8.3.7 Research Objective 7	197
8.3.8 Research Objective 8	198
8.3.9 Research Objective 9	201
8.4 SIGNIFICANCE AND IMPLICATIONS OF THE STUDY	202
8.4.1 Significance from a Personal Perspective	203
8.4.2 Significance for Researchers, Teachers and Policy Makers	203
8.5 LIMITATIONS OF THE STUDY	205
8.5.1 The Insider-Outsider Dichotomy	205
8.5.2 A Limited Time Frame	206
8.5.3 The Political Instability	206
8.5.4 Presence of the Researcher	206
8.5.5 Instruments used	207
8.5.6 Inclusion of Varied Data	207
8.6 DIRECTIONS FOR FUTURE RESEARCH	207
8.6.1 Replication of the Study	208
8.6.2 Parallels of the Study	208
8.6.3 Teachers, Principals, Parents and Policymakers in the Study	209
8.6.4 Comparative Study	209
8.6.5 Narratives in the Study	209

8.7 SUMMARY AND CONCLUDING REMARKS	210
REFERENCES	211
APPENDICES	239

LIST OF FIGURES

FIGURE 2.1	CLASSIFICATION OF INTERPERSONAL BEHAVIOUR INTO SIXTEEN MECHANISMS OR REFLEXES.	43
FIGURE 2.2	LEVEL TWO CLASSIFICATION OF INTERPERSONAL BEHAVIOURS INTO SIXTEEN VARIABLE CATEGORIES.	44
FIGURE 2.3	THE TWO-DIMENSIONAL COORDINATE SYSTEM OF THE LEARY MODEL.	46
FIGURE 2.4	THE TWO-DIMENSIONAL COORDINATE SYSTEM OF THE LEARY MODEL.	48
FIGURE 2.5	THE MODEL FOR INTERPERSONAL TEACHER BEHAVIOUR.	49
FIGURE 2.6	ASSOCIATIONS BETWEEN QTI SCALES AND STUDENT COGNITIVE OUTCOMES.	59
FIGURE 2.7	ASSOCIATIONS BETWEEN QTI SCALES AND STUDENT ATTITUDINAL OUTCOMES.	60
FIGURE 4.1	CORRELATION OF LEADERSHIP SCALE WITH OTHER QTI SCALES.	94
FIGURE 4.2	STUDENTS' PERCEPTIONS OF INTERPERSONAL TEACHER BEHAVIOUR IN SCIENCE CLASSES ON THE QTI SCALES.	96
FIGURE 4.3	STUDENTS' PERCEPTIONS OF SCIENCE CLASSES USING WIHIC SCALES.	101
FIGURE 5.1	MEANS FOR GENDER DIFFERENCES IN STUDENTS' PERCEPTION OF TEACHER-STUDENT INTERACTIONS MEASURED BY THE QTI SCALES.	110
FIGURE 5.2	MEANS FOR GENDER DIFFERENCES IN STUDENTS' PERCEPTIONS OF LEARNING ENVIRONMENTS MEASURED BY THE WIHIC SCALE.	111
FIGURE 5.3	MEANS FOR CULTURAL DIFFERENCES IN STUDENTS' PERCEPTION OF TEACHER-STUDENT INTERACTIONS MEASURED BY THE QTI SCALES.	115

FIGURE 5.4 MEANS FOR CULTURAL DIFFERENCES IN STUDENTS' PERCEPTIONS OF CLASSROOM LEARNING ENVIRONMENT AS MEASURED BY THE WIHIC SCALES.

LIST OF TABLES

TABLE 2.1	SCALE DESCRIPTION FOR EACH SCALE AND EXAMPLE OF ITEMS IN THE WHAT IS HAPPENING IN THIS CLASS? (WIHIC) QUESTIONNAIRE	30
TABLE 2.2	DESCRIPTION AND EXAMPLE OF ITEMS FOR EACH SCALE IN THE QTI	52
TABLE 4.1	SCALE INTERNAL CONSISTENCY (CRONBACH ALPHA RELIABILITY) AND ABILITY TO DIFFERENTIATE BETWEEN CLASSROOMS (ANOVA RESULTS) FOR THE QTI	88
TABLE 4.2	COMPARISON OF THE ALPHA RELIABILITY COEFFICIENTS (INTERNAL CONSISTENCY) FOR THE QTI SCALES IN SIX DIFFERENT COUNTRIES.	90
TABLE 4.3	COMPARISON OF THE AMOUNT OF VARIANCE ACCOUNTED FOR BY CLASS MEMBERSHIP (ETA^2) FOR THE QTI IN FIVE COUNTRIES.	91
TABLE 4.4	INTER-SCALE CORRELATION FOR THE QTI	93
TABLE 4.5	MEAN AND STANDARD DEVIATION SCALES OF THE QTI	95
TABLE 4.6	SCALE INTERNAL CONSISTENCY (CRONBACH ALPHA RELIABILITY), DISCRIMINANT VALIDITY (MEAN CORRELATION WITH OTHER SCALES) AND ABILITY TO DIFFERENTIATE BETWEEN CLASSROOMS (ANOVA RESULTS) FOR THE WIHIC	97
TABLE 4.7	COMPARISON OF THE ALPHA RELIABILITY COEFFICIENTS (INTERNAL CONSISTENCY) FOR THE SCALES OF THE WIHIC IN FIVE DIFFERENT COUNTRIES.	98
TABLE 4.8	COMPARISON OF THE AMOUNT OF VARIANCE ACCOUNTED FOR BY CLASS MEMBERSHIP (ETA^2) FOR THE WIHIC IN FOUR COUNTRIES.	99
TABLE 4.9	MEANS AND STANDARD DEVIATIONS FOR WIHIC SCALES.	100

TABLE 5.1	ASSOCIATIONS BETWEEN QTI SCALES AND ATTITUDE TO SCIENCE CLASS IN TERMS OF SIMPLE CORRELATIONS (r), MULTIPLE CORRELATIONS (R) AND STANDARDIZED REGRESSION COEFFICIENT (β)	105
TABLE 5.2	ASSOCIATIONS BETWEEN WIHC SCALES AND ATTITUDES TOWARDS SCIENCE CLASS IN TERMS OF SIMPLE CORRELATIONS (r), MULTIPLE CORRELATION (R) AND STANDARDISED REGRESSION COEFFICIENT (β)	107
TABLE 5.3	ITEM MEAN AND STANDARD DEVIATION FOR GENDER DIFFERENCES IN STUDENTS' PERCEPTIONS OF TEACHER-STUDENT INTERACTION MEASURED BY THE QTI SCALES	109
TABLE 5.4.	ITEM MEAN AND STANDARD DEVIATION FOR GENDER DIFFERENCES IN STUDENTS' PERCEPTIONS OF LEARNING ENVIRONMENT MEASURED BY WIHC SCALES	112
TABLE 5.5	ITEM MEAN FOR CULTURAL DIFFERENCES (LANGUAGE SPOKEN AT HOME) IN STUDENTS' PERCEPTIONS OF TEACHER-STUDENT INTERACTIONS MEASURED BY THE QTI SCALES.	114
TABLE 5.6	ITEM MEAN FOR CULTURAL DIFFERENCES (LANGUAGE SPOKEN AT HOME) IN STUDENTS PERCEPTIONS OF CLASSROOM LEARNING ENVIRONMENT AS MEASURED BY THE WIHC SCALES	116
TABLE 5.7	ITEM MEANS FOR RELIGIOUS DIFFERENCES IN STUDENTS' PERCEPTIONS OF TEACHER-STUDENT INTERACTIONS MEASURED BY THE QTI SCALES.	119
TABLE 5.8	ITEM MEAN FOR CULTURAL DIFFERENCES IN STUDENTS PERCEPTION OF THEIR CLASSROOM ENVIRONMENT AS MEASURED BY THE WIHC SCALES.	121
TABLE 5.9	ASSOCIATIONS BETWEEN QTI SCALES AND STUDENTS COGNITIVE ACHIEVEMENT IN TERMS OF SIMPLE CORRELATIONS (r) AND STANDARDISED REGRESSION COEFFICIENTS (β)	123

TABLE 5.10 ASSOCIATIONS BETWEEN WIHIC SCALES AND STUDENTS COGNITIVE OUTCOMES IN TERMS OF SIMPLE CORRELATIONS (r) AND STANDARDISED REGRESSION COEFFICIENTS (β)

125

APPENDICES

Appendix A	Position of Jammu and Kashmir Within India	239
Appendix B	Number and Classification of Schools in Jammu Province.	240
Appendix C	Questionnaire	241
Appendix D	Letter of Consent Sent To Principals.	247
Appendix E	Items of the Questionnaire Selected as a Basis for Interview	249
Appendix F	Certificate of Participation	251
Appendix G	A Typical School Building	252
Appendix H	Classroom in Progress	253

CHAPTER ONE

INTRODUCTION

*Planning for a year, grow paddy
Planning for a decade, grow trees
Planning for a lifetime, educate children*

Old Chinese Proverb

1.1 BACKGROUND

This thesis has given me a chance to study in depth aspects associated with the field of teacher-student interaction and classroom learning environments in schools in India, the most populous country in the world with a population of over one billion. This interest was aroused in me on my exposure to Australian schools through my children first and secondly my later attending the course-work for the degree of Doctor in Science Education. In the beginning, the almost fully student-centred education system seemed very strange to me. For the whole of my life, I had studied and taught in the Indian system of education where mostly the classroom was teacher centred. In contrast to this, the idea of a student-centred classroom in India was not viewed as a practical possibility. Therefore, I was stimulated to investigate the nature of science classroom learning environment and teacher-student interactions in India. Through this study I hoped that these descriptions of science classrooms in India could be used to encourage change towards a more student centred system.

The Australian Foreign Minister Alexander Downer, while releasing a white paper on February 12th, 2003, outlining his country's foreign policy elaborated on India's growing importance in international affairs. The paper stated that India's economy is

growing steadily from a significant base...making it important for us to engage India on strategic matters". The minister further said that both governments, Australian and Indian, are committed to developing a more dynamic and forward-looking approach to bilateral relationships.

Every year many students from the sub-continent are coming to Australia for higher education. While interacting with students who come to Australia only for pursuing university education, I found that those, who are just out of school, have a mixed type of reaction to university education in Australia. Some feel there is a very wide gulf between the two systems and it is impossible for students coming from one system to fit into the other system of education while others feel that the basic skeleton of education is the same. According to the second group of students, the structure is definitely different but the ultimate results may be the same. Here students put more emphasis on the style of teaching and learning, interactions between student and teacher, and above all the learning environment. This mixed reaction of students prompted me to undertake this study and investigate what are the differences and similarities in the two systems, so that guidelines for a bridging course can be given and students intending to enter Australian Universities find the journey much smoother.

As an observer, I found that in this journey male and female students interacted with their teachers differently and had a different perception of the same learning environment. Students coming from the same environment but with different perceptions react to a situation in different ways. Keeping this limitation in view the attitudinal differences towards interacting with teachers and the perceptions of learning environments by the different sexes was investigated.

Last but not least, the already existing learning environment instruments, namely, the *Questionnaire on Teacher Interaction* (QTI) and the *What is Happening in This Class* (WIHIC) which have been validated for use during the last decade or so were further validated for the first time in India. Significantly, the validation of these instruments

makes them more available for use in future learning environment studies in India. This chapter introduces the thesis under following headings:

- 1.2 Conceptual Framework
- 1.3 Theoretical Framework
- 1.4 Objectives of the study
- 1.5 Significance of the study
- 1.6 Limitations of the study
- 1.7 Education in India
- 1.8 Overview of the Thesis

1.2 CONCEPTUAL FRAMEWORK

The present study is built on elements of constructivism (Schwandt, 1994; Taylor, 1994; von Glaserfeld, 1987, 1993) and critical theory paradigms (Giroux, 1983, 1988; Kincheloe & McLaren, 1994; McLaren, 1989). On the whole, a multi-method approach was adopted to gain an insight into teacher-student interactions and classroom learning environments created in India.

Paradigms, or interpretative frameworks, help to guide and inform inquiry and are described in terms of ontology (the nature of reality), epistemology (the nature of the relationship between the knower and what can be known) and methodology (the means by which the knower came to know) (Guba & Lincoln, 1994). This study has been carried out within the realistic ontology of constructivism, where it is assumed that there are multiple realities in which researcher/researchers and their subject/subjects create their own understandings (Schwandt, 1994; von Glaserfeld, 1987, 1993). Gergen's (1995) social constructivist approach also closely influenced the present study. The social constructivist approach centres on the idea of the "world being constructed, or even autonomously invented, by inquirers who are simultaneously participants in those same worlds" (Steier, 1995, p. 70). The main concern of social constructivism is with language. Gergen (1995) believes that,

meaning is achieved through dialogue and communication between two or more persons, and is concerned with “negotiation, cooperation, conflict, rhetoric, rituals, roles and social scenarios”.

The critical theory perspective also influenced the present study. This perspective assumes a historical-realist ontology which implies that reality is shaped over time by social, political, cultural, ethnic and gender factors (Guba & Lincoln, 1994). Epistemologically, this paradigm assumes that the values of the researcher will influence the enquiry. Few elements were drawn from the feminist theory which is related to the critical theory. The feminist perspective assumes a materialist-realist ontology from which the “real world makes a material difference in terms of race, class and gender (Denzin & Lincoln, 1994, p. 14). According to Giroux (1991), researchers need to place themselves in their work (in terms of race, gender and culture) in order to determine and negotiate the stance taken with participants in with relation to domination.

A practice being advocated by critical theory and feminist theory is the researcher’s critical reflection and reflexivity (Fonow & Cook, 1991). According to critical reflection theory, the researcher is an integral part of the setting, context and culture that she or he is trying to represent or understand. Through reflexivity, the researcher has interactions with respondents through dialogue, which enables the researcher to reach a ‘transformative’ point (Giroux, 1998) and all the misapprehensions are confronted. The critical reflexivity gives a chance to hear the opinion of the participants studied, and this has been an important aspect of this study.

The traditional objectivist view has been challenged in this study where inquiry is a reflection of the knowledge of the world. In the case of constructivism, the researcher’s view is that of a passionate participant (whereby the researcher voices his or her own construction as well as the construction of the other participants), and, in the case of critical theory, is that of ‘transformative intellectual’ (Giroux, 1988), where ignorance is confronted and greater insight is developed into the inquiry.

The epistemology of this study can be described with the analogy of the researcher as a bricoleur (Denzin & Lincoln, 1994). The objectives of this study formed the basis for the methodology by which the data were collected from multiple methodologies and patched together to ‘bricolage’ to achieve these objectives.

1.3 THEORETICAL FRAMEWORK

The present study was carried out to examine and explore current teacher-student interaction and classroom learning environments in science classes in India. Most of the instruments that are used in learning environment studies are related to the theoretical framework for human environments proposed independently by Moos (1968) and Walberg (1968). While working on a Harvard Project Physics nearly three and a half decades ago, Herbert Walberg began a pioneering effort in the use of classroom environment assessment when evaluating curriculum innovations (Anderson & Walberg, 1968; Walberg, 1968; Walberg & Anderson, 1968). Harvard Project Physics (HPP) was a project involving about 80 physicists and teachers and was established to produce a one-year junior high school and college physics course (Collette, 1973, p. 113). This work ultimately led to the development of the *Learning Environment Inventory* (LEI). After the development of the LEI (Anderson & Walberg, 1968; Fraser, Anderson, & Walberg, 1982; Walberg & Anderson, 1968) more research was conducted into investigating the learning environment from the perspective of students, who actually make up a classroom.

Around the same time, Moos, in his research on human environments (Moos, 1974; Moos, 1979a; Moos, 1979b; Moos, 1979c; Moos & Houts, 1968; Moos, Insel & Humphry, 1974; Moos & Trickett, 1974; Moos & Trickett, 1987) found that diverse learning environments can be characterised in three general categories. This finding emerged from Moos’ work in variety of environments (Moos, 1968; Moos & Houts, 1968) including psychiatric hospital wards, school classrooms, correctional

institutions, military companies, university residences and work-place environments (Moos, 1979a). The three dimensions recognised are: Relationship dimensions which identify the nature and intensity of personal relationships within the environment and assess the extent to which people are involved in the environment and support and help each other; Personal Development dimensions which assess personal growth and self enhancement; and System Maintenance and System Change dimensions which involve the extent to which the environment is orderly, clear in expectations, maintains control, and is responsive to change (Moos, Insel, & Humphrey, 1974). Some of this research resulted in the development and validation of the *Classroom Environment Scale* (CES) (Moos & Trickett, 1974; 1987).

During the 1980s much more attention was devoted to research on teachers than had been the case in 1950s and 1960s, (Wubbels & Levy, 1993). Research in the field of teacher-student interpersonal behaviour experienced a surge of research interest, particularly in The Netherlands, which resulted in the development of a useful questionnaire based on a circumplex model to assess teacher-student interpersonal behaviour (Wubbels & Levy, 1991, 1993).

The interactions and interpersonal behaviour between teachers and their students provides an example of an important relationship dimension that forms one of the main strands of this study. This work developed from the work of Leary, who devised a system for measuring and representing specific relationship dimensions using a two dimensional model (Leary, 1957). This was later adapted by Wubbels, Creton, Levy, and Hooymaners (1993) into an eight-sectored model. The present study extends and builds upon the work in learning environment research, started more than three decades ago by Moos and Walberg, to classrooms in India.

Past research has emphasised that in order to improve student attitudes and achievement it is essential to create learning environments that emphasise the characteristics found to be positively associated with attitudes and achievement, (e.g., Brekelmans, Wubbels, & Creton, 1990; German, 1994; Henderson, Fisher, & Fraser,

1995; Rawnsley, 1997; Wubbels, Brekelmans, & Hooymayers, 1991). It has also been reported that students' willingness to learn results in positive attitudes and, is closely related to the teacher's method of teaching (Kounin, 1970). Similarly, the socio-cultural aspect of classroom environment also has an effect on students' attitudes and learning (Jegede & Okebukola, 1992).

Previous studies have also reported associations between the sex of students and student perceptions of the psychological learning environments in science classrooms (Byrne, Hattie, & Fraser, 1986; Fisher, Fraser, & Rickards, 1997; Fraser, Giddings, & McRobbie, 1991, 1992; Lawrenz, 1987). Previous research also has reported on differences in cognitive achievements of different sexes (Husen, Fagerlind, & Liljefors, 1974; Keeves & Kotte, 1995, Rickards, 1999) and student attitudes (Friedler & Tamir, 1990; Rickards, 1999; Schibeci & Riley, 1986; Wareing, 1990). Rickards (1999) studied the variable of student's cultural background as an indicator on achievement and attitude. The present study included all of these variables with the Indian sample, where for the first time such an inquiry was conducted in that part of the world.

This study was conducted with year 9 and 10 students during regular class time and towards the end of the academic year so that students could make clearer opinion about the interaction with teacher and the learning environment created. The selection of research methods was drawn from a number of interpretative perspectives, including survey research, hermeneutics, phenomenology and feminism (Erickson, 1998; Taylor & Dawson, 1998). Dialectic tensions and critical reflexivity led to inclusion of culturally sensitive methods of collecting data that would take into account the social action is 'locally distinct and situationally contingent' (Erickson, 1998, p.1155). Using these methods, which assisted researcher to make a clearer picture, collected the data.

1.4 OBJECTIVES OF THE STUDY

For the first time the QTI and the WIHIC were administered to an Indian sample, therefore, the objectives of the study were:

1. to provide further validation information about the QTI (in terms of reliability, ability to differentiate between classrooms, and circumplex nature) when used with an Indian sample;
2. to provide further validation information about the WIHIC (in terms of reliability, factor structure, discriminant validity and ability to differentiate between classrooms) when used with an Indian sample;
3. to compare the Indian means on the QTI and the WIHIC with mean scores from previous studies in other countries;
4. to investigate associations between Indian students' perceptions of teacher-student interactions and attitudes to science;
5. to investigate associations between students' perceptions of learning environments in India and attitude to science;
6. to investigate associations between teacher-student interactions and cognitive achievement;
7. to investigate association between students' perceptions of their classroom learning environments and their cognitive achievement;
8. to investigate if there are any differences between different gender, cultural and religious groups of students and their perceptions of teacher-student interactions and classroom learning environment and

9. to conduct observations and in-depth interviews with students in order to explain the association between students' attitudes and achievements, and how cultural factors affect student outcomes.

1.5 SIGNIFICANCE OF THE STUDY

This study was quite significant since it was for the first time any learning environment research had been undertaken in Jammu, India. The study focused on the students who are the main focus point in the teaching/learning process. Both the nature of teacher-student interaction and students' perception of their science classroom learning environments were explored. Students' attitudes towards their interaction with the science teachers and science lessons were also examined. Cultural factors that also may influence the performance of students were also studied (Barnouw, 1973; Fry & Ghosh, 1980). The associations between teacher student interaction, students' perceptions about their science classrooms and student outcomes were also examined. Furthermore the factors that could be affecting the learning of students in India were explored. On the whole, this study is a pioneer study as for the first time a sample from India was examined.

The people of Jammu and Kashmir have been living in politically disturbed conditions for more than a decade. The present generation of high school students have all been through an educational experience while living in politically uncertain conditions. In this study, an effort was made to analyse the effects of such socio-political situations on students.

Although many studies have been carried out on examining teacher-student interactions and students' perceptions of learning environment using the QTI and the WIHIC, none have been able to compare the means of the scales of these instruments with those from India. As such, the present study provides a basis upon which an

Indian sample can be included in the future for comparative studies on learning environment.

This study also furnished teachers and policy makers with data regarding the present learning environment status in Jammu, India. Prior to this study, the teachers and policy makers had no research data on which to base their decisions for future development. This study has given future researchers data on which they can base further studies. Furthermore, the information provided has the potential to assist teachers in identifying factors that contribute towards creating a positive learning environment that fosters positive attitudes towards science classes.

1.6 LIMITATIONS OF THE STUDY

The major draw back with this study was the political instability of the place where the study occurred. Keeping the security problem in mind, only the urban population could be selected. Although the present study has provided very useful and valid information, in the future it could be replicated in rural and government schools.

The limitation of time and the nature of the thesis also restricted the scope and sample size. The unstable political scenario in the city was constantly disturbing the school working. The researcher spent a total of ten weeks in the city of Jammu, but it would have been more rewarding, in terms of getting a better understanding of the student-school culture, if she could have spent more time interviewing and observing the classes.

The other limitation on the study was the range of participants providing data. In addition to the students who participated actively, teachers, principals, parents, policymakers and other members of the community could have been included in the study to make it more comprehensive. Because of the physical limitations, this was not possible this time.

The physical location of the state of Jammu and Kashmir within India and its neighbouring countries can be seen in Appendix A. The total number and type of schools in Jammu and Kashmir can be seen in Appendix B.

1.7 EDUCATION IN INDIA

1.7.1 Background

According to Encarta (2000), formal education in India was well established as early as 1200BC. Local priests ran the educational institutions and science was one of the major disciplines of instruction. During the British colonisation, the present system of education came into existence and at present this is the only officially recognised educational system. The primary aim of such a school was to select, filter out the bulk of population and select a few who could help the rulers. This also implied that those involved in the development and running of the school system were also its principal users and beneficiaries.

In the words of Mahatma Gandhi,

‘ I say without fear of my figures being challenged successfully, that today India is more illiterate than it was fifty or a hundred years ago, because British administrators, when they came to India, instead of taking hold of things as they were, began to root them out. They scratched the soil and began to look at the root, and left the root like that, and the beautiful tree perished. The village schools were not good enough for the British administrator, so he came out with his program. Every school must have so much paraphernalia, building, and so forth. Well, there were no such schools at all. There are statistics left by a British administrator which show that, in places where they have carried out a survey, ancient schools have gone by the board, because there was no recognition for these schools, and the schools established after the European pattern were too expensive for the people, and therefore they

could not possibly overtake the thing' (Mahatma Gandhi at Chatham House, London, October 20, 1931)

The above paragraph gives us a clear picture of the state of education in India in early to mid-twentieth century. Independence led to the emergence of a strong political will to universalize education. Incentives were given to first generation learners. However, even though the profile of students entering schools has changed radically, the practices in the school have hardly been revised to take change into account. The teacher training continues to be traditional, concentrating on elementary communication skills (Kulkarni, 1988).

India became free from British colonisation in the year 1947 and in the year 1952, implemented her own constitution. By then, the British system of education had taken deep roots and was the basis on which the existing educational policy was formulated.

1.7.2 National Policy on Education

India's commitment to the spread of knowledge and freedom of thought among its citizens is reflected in its Constitution. The Directive Principle contained in Article 45 states, "The State shall endeavour to provide within a period of ten years from the commencement of this constitution, for free and compulsory education for all children until they complete the age of fourteen years".

Educational policy and progress have been reviewed in the light of the goals of national development and priorities set from time to time. In its Resolution on the *National Policy on Education, 1968* there is an emphasis on quality improvement and a planned, more equitable expansion of educational facilities.

About a decade and a half later, in the year 1986 the *National Policy on Education* (NPE-1986) was formulated and was further updated in 1992. The NPE 1986 provides a comprehensive policy framework, for the development of education up to

the end of the century and a 'Plan of Action' (POA) 1992, assigning specific responsibilities for organising, implementing, and financing these proposals. In the year 2000-2001, a total expenditure on education in India was 4.11% of the total GNP (Source-Selected Educational Statistics).

The following are among the distinguishing features and recommendations of this policy:

Since the inception of this present educational system, there have been changes from time to time. Major changes were implemented by The National Council for Educational Research and Training (NCERT) in the early 1980s. Until that time, there was no uniformity in the educational systems in all the 32 states of the country. The NCERT gave a general guideline, which could be followed by the state boards. This system brought uniformity in the system and we can be confident that a sample taken from one state can be representative of the rest of the population.

The teaching of science as a part of general education up to year ten was re-emphasised in the *National Policy on Education-1986* (Malhotra, 1998). The task of developing curriculum and related instructional material in science was entrusted to the Department of Education in Science and Mathematics (DESM), National Council for Educational Research and Training (NCERT). Drafts of the guidelines for science education were developed keeping in view the spirit of the *National Policy on Education* and *Curriculum Framework*. Keeping these guidelines in view, books were written and efforts were made to provide more activities and facilitate learning (Balasubramanian, 1998).

Although NCERT has made a lot of effort to revise the curricula, there is no evidence of creating good learning environments in schools. Also, there has been no effort to investigate the Indian educational system and compare it with the rest of the world. Keeping the present global conditions in view, it is very important for all countries to have compatible/comparable outcomes. Science education research, which crosses

national boundaries, offers much insight for two reasons (Fraser, 1997). Firstly, there usually is greater variation in variables of interest (teaching methods, student attitudes) or the taken-for-granted familiar educational practices, beliefs and attitudes in one country can be exposed, made 'strange' and questioned in another country (Fraser & Tobin, 1998). In an effort to "provide a refreshing alternative to...research reports, which malign science education and highlight its major problems and shortcomings" (Fraser & Tobin, 1991), this study was undertaken. This is also in line with the research quoted by Fraser and Tobin (1991) which highlights educational accomplishments and paves the way for improvements in schooling.

1.8 OVERVIEW OF THE THESIS

This thesis consists of eight chapters presenting the design, development and findings of the study. This first chapter has introduced and summarised the purpose of this study and outlines the objectives, provides a brief overview of the limitations, and discusses the significance of the study.

A review of literature pertinent to the study is presented in Chapter 2. In this chapter, literature describing learning environment research, classroom environment research, student-teacher interaction research and students' attitudes are examined. Review of literature from studies using the Questionnaire on Teacher Interaction and the What is Happening in This Class is also presented.

The details regarding the methodology used in this study are outlined in Chapter 3. In addition, difficulties endured during data collection are given. Descriptions are provided of the selected research methods, in addition to the analysis and interpretation of data at each stage of investigations.

Details of validation data for the QTI, the WIHIC and the Attitude Scale are presented in Chapter 4. The comparisons of the mean scores obtained from studies

from other countries for all the three instruments with the scores from Jammu, India are also presented.

The data from other quantitative measures studied are presented in Chapter 5. These include associations between attitudes, gender, cultural backgrounds, religious faiths and cognitive achievements with teacher-student interactions and the classroom-learning environment in Jammu, India.

Qualitative data from the interviews is presented in Chapter 6. These data report on further validation of the QTI and the WIHIC by comparing the means scores of these instruments with the interview responses by the students.

The results of the analysis of the classroom observations conducted during the study are reported in Chapter 7. This chapter is presented as an educational criticism (as suggested by Eisner, 1994) and is particularly concerned with those factors outside the scope of the QTI and the WIHIC questionnaires, including social, cultural and political factors, that might influence the existing teacher-student interactions and classroom learning environments.

Finally, Chapter 8 reports the major findings with reference to the research objectives. This chapter also provides implications, limitations and conclusions of this study. Future directions for research based upon the findings of this study are suggested.

Following the references there are several appendices consisting of a full set of questionnaires as used in this study, the interview schedule, and the map of Jammu and Kashmir within India and its neighbouring countries.

1.9 CHAPTER SUMMARY

This first chapter has outlined the background and the personal motivation that led to the origin of this thesis, together with the conceptual and theoretical framework, objectives and significance of the study. The limitations of this research are also acknowledged in this chapter. A brief overview on the educational history, system and policy in India is also given so that the reader can have a clear picture of the context in which the study took place. Lastly, in this chapter, a brief overview of the content of each chapter contained in this thesis is presented.

CHAPTER TWO

LITERATURE REVIEW

*We are convinced more by the arguments,
That we our selves have discovered
Than by those, that have been produced for us by others.*
Pascal

2.1 INTRODUCTION

My readings of the literature for this study were diverse and I went along some interesting paths. I began by working through papers set as readings for the unit on learning environments as a coursework for doctoral studies. Lewin (1936), Murray, (1938), Walberg, Singh, & Rasher (1977), Moos (1974), and Fraser (1979), became familiar names to me. Then I moved towards more recent work on learning environments and read articles on students' perceptions of classroom environment and cognitive and affective outcomes (Fraser, 1986, 1991, 1994) and studies on classroom environment and variance in student outcomes (Fraser & Fisher, 1982a, 1982b; Wong & Fraser, 1994). During this time, I engaged myself in self-reflective writings about my past experiences. Throughout the study, I continued this reading of one view of learning, and then another, because like Sfard (1998) suggests, I found different perspectives allow differing insights.

The primary aim of the present study was to examine associations between teacher-student interactions, students' perception of their classroom learning environment, student sex and student cultural background in years 9 and 10 in India. In addition, the study also collected data on student outcomes for cognitive achievement and

attitude to the subject. The literature relevant to this study is reviewed in this chapter using the following headings:

2.2 Introduction to Research on Learning Environments

2.3 The Development of Learning Environment Instruments

2.4 The Study of Perceptions of Classroom Learning Environments.

2.5 The Study of Teacher-Student Interactions

2.6 Student Attitudes

2.2 INTRODUCTION TO RESEARCH ON LEARNING ENVIRONMENTS

An examination of past reviews of research (Aldridge, Fraser & Huang, 1999; Anderson, 1982; Fraser, 1991; Fraser & Walberg, 1981a; Templeton & Johnston, 1998; Wubbels, Creton, & Hooymayers, 1992) shows that international research efforts over the last three decades involving the conceptualisation, assessment and investigation of perceptions of various aspects of the classroom learning environment has been a thriving field of study. Furthermore, science education researchers have led the world in the field of classroom environment research, and this field has contributed much to understanding and improvement of science education (Aldridge, Fraser, & Haung, 1999; Anderson, 1982; Fraser, 1991; Fraser 1998b; Fraser & Walberg, 1981a; Rickards & Fisher, 1999; Wubbels, Creton, & Hooymayers, 1992). Classroom environment assessment provides a means of monitoring, evaluating and improving science curriculum planning and teaching.

Considerable progress has been made over the last four decades in the conceptualisation, assessment and investigation of the important but subtle concept of learning environments (Fraser, 1986, 1994, 1988a, 1998b; Fraser & Walberg, 1991; McRobbie & Ellett, 1997; Wubbels & Levy, 1993). Research in the past two decades has also employed the use of qualitative methods in learning environment research (Anstine Templeton & Nyberg, 1997; Tobin, Kahle & Fraser, 1990), and also the combination of both qualitative and quantitative methods (Aldridge, Fraser, &

Huang, 1999; Anstine Templeton & Johnson, 1998; Fraser & Tobin, 1991; Johnson & Anstine Templeton, 1999; Tobin & Fraser, 1998). There have been investigations into associations between students' perceptions of the classroom environments and student cognitive and affective outcomes (Fraser, 1986, 1991, 1994). Such studies have reported that students' perceptions of the classroom environment consistently account for considerable variance in student outcomes (Fraser & Fisher, 1982a, 1982b; Wong & Fraser, 1994). The idea of 'grain sizes' (the use of different-sized samples to answer different questions within a study) in learning environment research has been used effectively in studies that combine qualitative and quantitative methods of data collection (Fraser & Tobin, 1991; Tobin & Fraser, 1998).

A key advance in the thinking that contributed greatly to the study of learning environments was the Lewinian formula proposed by an exile from Nazi Germany, Kurt Lewin (1936). It is a key to the human interaction focus of this study in that it proposed that the environment and the personal characteristics of an individual determined human behaviour. This theory was expressed in the formula that human behaviour (B) is a function of both the personality of the individual (P) and the environment (E).

$$B=f(P, E)$$

This formula was to provide a motivating force for new research strategies (Fraser, 1994; Stern, 1970).

Murray (1938) developed a theory to describe an individual's personal needs and environmental press. He defined needs as those specific, innate and personal requirements of an individual such as personal goals. An individual's need to achieve these goals, or their drive to attain them is also a factor in an individual's personality. The environmental factors that were beyond an individual's control that either enhanced or retarded the individual's achievement of their personal goals and needs were defined as press. Murray used the term *alpha press* to refer to an external

observer's perceptions of the learning environment and *beta press* to refer to observations by the constituent members of the environment under observation (Murray, 1938).

Stern, Stein, and Bloom, (1956) built on Murray's discrimination between *alpha press* and *beta press*. They suggested that *beta press* could further be discriminated by the individual view and experience of the environment that each student, for example, has of the learning environment versus the shared view that the students have as a group of participants in the learning environment. They used *private beta press* to represent the idiosyncratic view a student may have of the classroom environment and *consensual beta press* for the shared view of the students' perceptions. This study utilises the student *consensual beta press* perspective for the data collected through survey and observation methods and *private beta press* perspective for the interviews conducted with the students.

Classroom research methods about three decades ago were centred on observation techniques where trained observers would categorise classroom activities and interactions between members of the class. Along with an improvement in observation procedures and techniques (Brophy & Good, 1986), came a categorisation of observations as either high or low inference measures which were defined as the specific items that were recorded during classroom observations sessions. High-inference measures recorded during classroom observations required the observer to make an inference about the teacher's behaviour in terms of such aspects as warmth, clarity or overall effectiveness. Either a member of the classroom environment or an outside observer could make high-inference observations.

Murray's needs-press model was utilised and extended (Pace & Stern, 1958) to report on high inference measures in educational learning environments. A problem with outside observers is that they must make judgements on the observations that are based on experiences external to the learning environment. Further to this, Pace and Stern (1958) suggested that an assessment of the relationships between the

environmental press and a student's needs might be useful in predicting personal achievement.

2.3 THE DEVELOPMENT OF LEARNING ENVIRONMENT INSTRUMENTS

There is a dichotomy in learning environment research that centres either on the school-level environment or on the classroom-level environment (Anderson, 1982; Fraser & Rentoul, 1982; Fraser & Walberg, 1991). The theoretical and conceptual frameworks for these two levels of learning environment research share some commonality but are generally different and evolved separately. Fraser (1994) suggested that there was little knowledge of each area's work despite the similarities in research. In this study, the classroom was selected as the level of learning environment to be studied.

In this section, I describe many of the instruments that have been used to assess the quality and nature of the classroom learning environment over the last three decades. As discussed in Chapter One, Moos' work (1974) has influenced the development and application of many instruments used to assess the qualities of the classroom learning environment from the perspective of a student. As the scales of all of the instruments mentioned in this section can be categorised into one of the dimensions of Moos' scheme for classifying human environments, there is some commonality in the underlying conceptual frameworks for assessment of classroom environment.

Examples of classroom environment instruments are:

- *Learning Environment Inventory* (LEI)
- *My Class Inventory* (MCI)
- *College and University Classroom Environment Inventory* (CUCEI)
- *Classroom Environment Scale* (CES)

- *Individualised Classroom Environment* (ICEQ)

Questionnaire

- *Science Laboratory Environment Inventory* (SLEI)
- *Constructivist Learning Environment Survey* (CLES)
- *Geography Classroom Environment Inventory* (GCEI)
- *Computer Classroom Environment Inventory* (CCEI)
- *Cultural Learning Environment Questionnaire* (CLEQ)
- *Distance and Open Learning Environment Survey* (DOLES)
- *Socio-Cultural Environment Scale* (SCES)

The Learning Environment Inventory (LEI)

The initial development and validation of the preliminary version of the LEI began in the late 1960s in conjunction with evaluation and research related to Harvard Project Physics (Fraser, Anderson, & Walberg 1982; Walberg & Anderson 1968). According to Fraser and Walberg (1981a) the LEI, at that time was the most widely used perceptual measure of psychological environment in science education. The LEI measures student perceptions of 15 environment dimensions of secondary school classroom. The LEI was used to investigate learning environment more closely from the perspective of the students who make up a classroom rather than from the perspective of trained observers. The LEI has seven items per scale with a total of 105 items. The items are scored on four point Likert scale (Likert, 1932) with some items reversed. The LEI evolved from the 18-scale *Classroom Climate Questionnaire* developed by Walberg (1968). The LEI used 15 dimensions of the climate, which had previously been identified as good predictors of learning and were relevant to social psychological theory of the time (Fraser & Walberg, 1991).

The My Class Inventory (MCI)

The My Class Inventory (MCI) (Anderson & Walberg, 1968; Fraser, Anderson, & Walberg, 1982; Walberg & Anderson, 1968) is a simplified version of the LEI and has 38 items. The LEI was modified to improve comprehension by children in the 8-12 years of age (Fisher & Fraser, 1981; Fraser, Anderson, & Walberg, 1982; Fraser & O'Brein, 1985). The MCI also was found useful with students who had difficulty

reading the lengthy LEI (Fraser & Walberg, 1995). Another difference between the LEI and the MCI is that the MCI has been reduced to five scales as against 15 scales in the LEI. This made it more convenient and less tiresome for the younger students (Fraser & Walberg, 1991). Furthermore, the MCI has a simpler response format of yes or no and is scored directly on the questionnaire rather than on a separate response sheet. The original version of the MCI had 45 items but was modified and reduced to 38 items (Fisher & Fraser, 1981) to improve scale reliabilities.

The College and University Classroom Environment Inventory (CUCEI)

Until the development of the CUCEI (Fraser, Treagust, Williamson, & Tobin, 1987) there was no suitable instrument for use in tertiary education settings (Fraser & Walberg, 1991). The four initial criteria guiding the development of the CUCEI were economy of response time and data processing, selection of meaningful items that were relevant to, and understood by, university or college teachers and students, association of scales to the three general dimensions formulated by Moos (1974) and an examination of previous instruments to determine relevant scales at that time. This instrument needed to be tested at college or university levels (Fraser, Treagust, Williamson, & Tobin, 1987). Fisher & Parkinson, (1998) used it successfully to assess hospital-based nursing education classroom environments. The CUCEI has seven scales each with seven items scored on a four point Likert scale with about half of the items reversed. As with some other questionnaires, the CUCEI has been adapted to form instruments that are specific to particular studies. One example is the *Secondary Colleges Classroom Environment Inventory* (SCCEI) (Kent & Fisher, 1997) which was adapted from both the LEI and the CUCEI.

The Classroom Environment Scale (CES)

The Classroom Environment Scale (CES) was developed at Stanford University by Moos (Moos, 1974; Moos, 1979a; Moos, 1979b; Moos & Trickett, 1987; Trickett & Moos, 1973) and was inspired by Moos' research in a number of work milieus including psychiatric hospital wards, school classrooms, correctional institutions, military companies, university residences and work place environments. The present

version in use has nine scales for use in secondary school classrooms with ten items in each scale. All the scales are scored on a true/false response list with about half the items being reversed. To determine the item content of the CES, a review of existing literature and a process of structured interviews were involved. The CES was primarily developed to examine the psychosocial environment of school classrooms from the perspective of participant interaction (Raviv, Raviv, & Reisel, 1990). This included behaviour exhibited by the teacher, teacher-student interactions and student-student interactions (Moos & Trickett, 1974; Moos & Trickett, 1987).

The Individualised Classroom Environment Questionnaire (ICEQ)

The Individualised Classroom Environment Questionnaire (ICEQ) was developed by Rentoul and Fraser (1979) to assess the dimensions, which distinguish individualised classrooms, from conventional ones. The original version of the ICEQ had five scales with 15 items per scale. The final version was reduced to 10 items in each scale giving a total of 50 items. The responses are recorded on a five point Likert-type scale with some items reversed. While developing the ICEQ the three main criteria that were adhered to were: the scales should characterise the learning environment upheld in inquiry based classrooms, scales should conform to the dimensions outlined by Moos (1979a) for conceptualising learning environments; and individual items should be salient to teachers and their students (Rentoul & Fraser, 1981). Fraser, (1990) developed a short form of the ICEQ, which has five scales with five items in each making a total of 25 items in the instrument. These items are equally divided among the scales and retain the same representation of positive and negative worded items.

The Science Laboratory Environment Inventory (SLEI)

The Science Laboratory Environment Inventory (SLEI) was specifically developed to assess the learning environments of science laboratory classes at the senior secondary or tertiary levels (Fraser, Giddings, & Mcrobbie, 1991) The SLEI consists of five scales with 34 items in total. Responses are scored on a five point Likert-type scale and approximately half of the items are reversed. The SLEI also conforms to the

dimensions outlined by Moos (Fraser, Giddings, & McRobbie, 1992). The SLEI was field tested and validated simultaneously with a sample of over 5,500 students in 269 classes in six different countries namely USA, Canada, England, Israel, Australia, and Nigeria (Hofstein & Lunetta, 1982).

Henderson, Fisher, and Fraser (1998) modified the SLEI to produce a variant known as the *Environmental Science Learning Inventory (ESLEI)*. The ESLEI was first used with 100 Environmental Science students in senior high schools in Tasmania, Australia.

The Constructivist Learning Environment Survey (CLES)

According to the constructivist view, meaningful learning is a cognitive process in which individuals make sense of the world in relation to the knowledge, which they already have constructed, and this sense-making process involves active negotiation and consensus building (Fraser, 1998b, Fraser & Walberg, 1991). The Constructivist Learning Environment Survey (CLES) (Taylor, Fraser, & Fisher, 1997) is designed to assist researchers and teachers assess the degree to which a particular classroom's environment is consistent with the constructivist epistemology. The initial four criteria guiding the development of CLES (Taylor, Fraser, & Fisher, 1993) were that the CLES had to be consistent with current literature, have a personalised response format, be economical to use and have high level of salience to teachers, researchers and students for whom it was intended. The original version of the CLES had 58 items with four scales that ranged from nine to twenty items. After further validation CLES was reduced to five scales having six items each giving a total of 30 items with only item 6 reversed. Taylor, Fraser & White (1994) arranged the items in groups of like items. This resulted in all the items for a particular scale being in the same group, which was a different approach to the more traditional cyclic arrangement of scale items in many other similar questionnaires.

Geography Classroom Environment Inventory (GCEI)

The Geography Classroom Environment Inventory (GCEI) was primarily designed to assess innovation and gender equity in computer-assisted learning environments in Singapore (Teh & Fraser, 1993, 1995). Although the original form of the instrument had eight scales, this was later reduced to only four scales following the factor and item analysis. Each of the four scales has eight items. These items are scored on a five point Likert-type scale. In this instrument nearly half of the items are reverse scored. The scale on gender equity was new, while the rest of the scales were adapted from other already existing instruments and modified to suit computer assisted classroom learning environments. The four main criteria guiding the development of GCEI were: consistency with the literature on computer-assisted learning, consistency with the dimensions set out by the Moos, salience to classroom environment researchers, teachers and students and lastly salience to computer-education experts.

Computer Classroom Environment Inventory (CCEI)

The Computer Classroom Environment Inventory (CCEI) was develop to assess the perceptions of learning environments which involve both inquiry learning methods and the use computer assisted instruction (Maor & Fraser, 1993, 1996). The initial version of the CCEI had 40 items but was later reduced to five scales with a total of 30 items. The responses are scored on a five point Likert-type scale, and some of the items are reversed. The main criteria adhered to while the development of CCEI were: consistency with the dimensions set out by Moos, consistency with the existing literature on inquiry learning and learning environment instruments, its ease and efficiency to complete and score and lastly being salient to teachers and the students in the target audience.

Cultural Learning Environment Questionnaire (CLEQ)

The Cultural Learning Environment Questionnaire (CLEQ) was developed by Waldrip and Fisher (1997a) to assess the culturally-sensitive factors of the classroom learning environment. The research on dimensions of culture (Hofstede, 1984) and

Moos' dimensions served as the main guide in the development of CLEQ. The questionnaire has eight scales with five items in each scale giving a total of 40 items. Waldrip and Fisher (1997b) used it very impressively with the individual student as the unit of analysis and its factor analyses resulted in retaining all the 40 items in eight scales. The six main criteria adhered to while the development of CLEQ were: consistency with previous learning environment research and literature, consistency with Hofstede's and Moos' dimensions, salience for teachers, and students in target audience and economy of operational requirements.

Distance and Open Learning Environment Survey (DOLES)

The Distance and Open Learning Environment Survey (DOLES) is a unique instrument developed by Jegede, Fraser, and Fisher (1998a; 1998b) to assess the growing need for research into university distance education settings particularly in science (Jegede, 1992). The initial version of the DOLES had 60 items. These were reduced in the final version to 52 items arranged into five core scales and two optional scales containing varying numbers of items. The optional scales are designed to be used for specific purposes or by students for whom these aspects are relevant. Responses are scored on a five point Likert-type scale. The criteria used in the development of the DOLES were: consistency with existing literature on learning environments, consistency with the previously constructed instruments for face-to-face learning environments, coverage of distance and open learning characteristics, economy in administration time and scoring responses and finally salience to teachers and students in the target distance and open education audience.

Socio-Cultural Environment Scale (SCES)

The Socio-Cultural Environment Scale (SCES) was developed by Jegede and Okebukola (1988) to assess students' perceptions of the socio-cultural environment of their classrooms. This instrument has five scales with six items in each scale making a total of 30 items. Responses are scored on a three point Likert-type response scale. Experts in African studies comprised of science educators, science teachers,

sociologists and anthropologists contributed to the development of SCES (Jegade & Okebukola, 1992).

2.3.1 Actual and Preferred Forms

A distinctive feature of most of the learning environment instruments is that they have, not only a form to measure perceptions of actual or experienced classroom environment, but also a form to measure perceptions of ideal or preferred classroom environments. The preferred forms are concerned with goal and value orientations and measure perceptions of the classroom environment ideally liked or preferred (Fraser & Walberg, 1991). Although the item wording is almost the same for both actual and preferred forms, there are slightly different instructions given for answering the forms. Students are instructed to rate their class what it is actually like for the actual form and what they would prefer it to be like for a preferred form.

2.3.2 Short and Long Forms of the CES, ICEQ and MCI

Some teachers over a period of time have reported that they would like to have classroom environment instruments available which would take less time to administer and score. Keeping this demand in view short forms of the CES, the ICEQ, and the MCI were developed (Fraser, 1982; Fraser 1994; Fraser & Fisher 1983). The main three criteria while developing the short forms were; total number of items in each forms was reduced to about 25 items to provide greater economy in time while administering and scoring the instrument, these short forms were developed to be amenable to easy hand scoring and lastly to provide adequate reliability for the assessment of the perceptions of applications which involve averaging the perceptions of students within a class to obtain small class means.

The *What is Happening in This Class* (WIHIC) and *Questionnaire on Teacher Interaction* (QTI) have not been discussed in this section. Both of these instruments were used in the present study and are discussed in detail in the following sections 2.4 and 2.5.

2.4 THE STUDY OF PERCEPTIONS OF CLASSROOM LEARNING ENVIRONMENTS

2.4.1 Development of ‘What is Happening in this Class (WIHIC) Questionnaire’

The WIHIC questionnaire brings parsimony to the field of learning environment by combining modified versions of the most salient scales from a wide range of existing questionnaires with additional scales that accommodate contemporary educational concerns (e.g., equity and cooperation) (Fraser, 1998). Based on the previous studies, Fraser, Fisher, and McRobbie (1996) developed this new learning environment instrument. *The What is Happening In This Class?* (WIHIC) consists of seven scales and 56 items with eight items in each scale (Fraser, Fisher, & McRobbie, 1996) providing an economical measure of the learning environment. The seven scales are Student Cohesiveness, Teacher Support, Involvement, Investigation, Task Orientation, Cooperation and Equity. Items in the questionnaire are arranged consecutively, to provide contextual cues to the reader.

The WIHIC, can be used to measure students’ perceptions from a class and personal viewpoint. The responses are recorded on a five point Likert type scale. The factor structure of the WIHIC has been established in many countries (Aldridge & Fraser, 2000, Fraser, McRobbie & Fisher, 1996), Singapore (Chionh & Fraser, 1998), Brunei (Riah & Fraser, 1998), and Taiwan (Aldridge & Fraser, 2000).

2.1. Scale Table

Description for Each Scale and Example of Items in the What Is Happening In This Class? (WIHIC) Questionnaire

Scale	Description	Item
Student Cohesiveness [SC]	Extent to which students know, help and are supportive of one another.	I make friendship among students in this class
Teacher Support [TS]	Extent to which teacher helps, befriends, trusts, and shows interest in students.	The teacher takes a personal interest in me.
Involvement [IV]	Extent to which students have attentive interest, participate in discussions, perform additional work and enjoy the class.	I discuss ideas in class.
Investigation [IN]	Extent to which there is emphasis on the skills and their use in problem solving investigation.	I am asked to think about the evidence for statements.
Task Orientation [TO]	Extent to which it is important to complete activities planned and to stay on the subject matter.	Getting a certain amount of work done is important.
Cooperation [CO]	Extent to which students cooperate rather than compete with one another on learning tasks.	I cooperate with other students when doing assignment work.
Equity [EQ]	Extent to which the teacher treats students equally.	The teacher gives as much attention to my questions as to other students' questions.

Responses to the items are scored 1,2,3,4,5 respectively, for the responses Almost Never, Seldom, Sometimes, Often, very Often. Missing or invalid responses are scored 2, the midrange value. A Copy of the questionnaire used in the study can be seen in Appendix 1.

The WIHIC questionnaire was used to measure students' perceptions of their classroom environments in this study and details regarding the validation of the

WIHIC are given in Chapter 4. Table 2.1 represents the nature of the WIHIC by providing a scale description and a sample item for each of seven scales

2.4.2 Review of Literature on Perceptions of Classroom Environment

Studies in Australia and other Western Countries:

Fraser (1994) in an evaluation of science curriculum materials developed by the Australian Science Education Project studied student perceptions of the learning environment as criterion variables. The study revealed that environmental variables differed significantly between curricula when differences in outcomes were negligible. Yet, in another study, the Individualised Classroom Questionnaire (ICEQ) was used to assess the degree of individualisation and proved useful for assessing changes in students' perceptions.

The differences between the perceptions of students and teachers of their classroom environment were studied using actual and preferred forms (Fisher & Fraser, 1983). The results of the study reported that teachers perceived their classrooms more favourably than did their students. In addition, students and teachers would prefer a more positive classroom environment than is perceived as being actually present. The same research when carried out in The Netherlands (Wubbels, Brekelmans, & Hoomayers, 1991) and Australia (Fraser & O'Brein, 1985) reported similar results.

Classroom environment changes across the transition from primary to high school also have been studied (Ferguson & Fraser, 1998). In this study, factors related to learning environments during the transition were explored and it was reported that changes were related to student sex and school size. Students coming from smaller primary schools experienced a larger deterioration in the perception of the learning environment. Students attending primary school on the same site as the high school experienced the most favourable changes in their perceptions of the learning environment during the transition.

Zandvliet and Fraser (1999) examined students' perceptions of the learning environment in Internet classrooms. In this study, links were found between psychosocial factors and student' attitudes. Further, links were also found between the psychosocial factors and the ergonomic environment (work space and visual environment).

The quality of learning environment is one of the aspects of teacher effectiveness (Fraser, 1986; Fraser, Walberg, Welch & Hattie, 1987). Studies of exemplary teachers in high school science and mathematics have also indicated that these teachers exhibit behaviours that positively affect the learning environment (Anstine-Templeton & Jensen, 1993; Ciupryk, Fraser, Malone, & Tobin, 1989; Hofstein, Ben-Zvi & Carmeli, 1990; Tobin & Fraser, 1989; Treagust, 1991). Tobin and Fraser's (1989) study of student perceptions of the psychosocial environment in classrooms of exemplary teachers (using short forms of My Class Inventory and Classroom Environment Scale) provided considerable evidence that exemplary teachers can be distinguished in terms of classroom environments, which they create. In particular, exemplary teachers created more favourable classroom environments.

Studies in Classroom Environment in Non-Western Countries:

One of the earliest research studies establishing the validity of classroom environment instruments carried out in a non-Western country was in India (Walberg, Singh, & Rasher, 1977). In this study, the classroom environment scale was translated into Hindi and validated. In this present study carried out in Jammu, India the medium of instruction was English so there was no problem in the application of the instrument in the English language.

Classroom environment scales were also translated and validated into Korean (Kim, Fisher & Fraser, 2000) and Indonesian (Schibeci, Rideng, & Fraser, 1987) languages. These studies reported associations between student outcomes and classroom environment perceptions, which replicated research in Western countries.

Suddaby (1989) measured aspects of the learning environment to evaluate the success of ideas and teaching methods that focus on cooperative relationships in Russia. Hofstein, Ben-Zvi & Carmeli (1990) examined the factors that helped to create a positive learning environment to determine tangible traits associated with exemplary teachers in Israel and Ratnaike (1985) used dimensions of the learning environment as a criterion for teacher training in Thailand.

The psychosocial environment of agricultural science classrooms was examined in Nigeria, (Idris & Fraser, 1997). The report of this study replicated the research into associations between the classroom environment and student outcomes in the Western countries in that more favourable learning environments resulted in improved student outcomes.

Soyibo and Figueroa (1998) assessed students' perceptions of the learning environment using the Science Laboratory Environment Inventory (SLEI) as a means of evaluating the *Reform of Secondary Schools Project* in Jamaica, West Indies. In this study, students from schools involved with the project were compared with those students attending that were schools not involved. However, the differences between the two groups of schools were negligible as reported in the results of the study.

A large-scale international study was conducted using the SLEI, where science laboratory classroom environments were compared across developed and developing countries (Hofstein & Lynetta, 1982). In this study students from Australia, Brunei, Cook Islands, Fiji, Singapore, Solomon Islands, Tonga, Tuvalu, USA, Vanuatu and Western Samoa were included. Students from developed as well as developing countries held similar views regarding their learning environment. It was concluded that there exists a cross-cultural base that results in most science teachers adopting similar teaching practices.

Quite a few studies related to classroom learning environments have been carried out in Singapore. These studies examined the classroom learning environments in

different subjects, namely, computing (Khoo & Fraser, 1998), geography (Teh & Fraser, 1994), mathematics (Chionh & Fraser, 1998; Goh & Fraser, 1998; Goh, Young, & Fraser, 1995) and chemistry (Wong & Fraser, 1996). The questionnaires used in these studies were in English and were validated for use in Singapore. The same approach was adopted in the study described in this thesis. The studies carried out in Singapore showed strong associations between the learning environments and the student outcomes.

Lee and Fraser (2000) investigated Korean high school students' perceptions about their science classrooms, focusing especially on the notions of constructivism. The Constructivist Learning Environment Survey instrument was used and validated for use in Korea. Strong associations between classroom environment and attitudes of students were found.

Qualitative methods involving open-ended questions were used to explore students' perceptions of the learning environment in grade nine mathematics classrooms in Hong Kong (Wong, 1993, 1996). Students in this study identified the teacher as the most crucial element in a positive classroom-learning environment. The teachers creating positive learning environments in class were friendly, showed concern for the students and maintained discipline. Yet in another study in Hong Kong, Cheung (1993) used a multilevel approach to determine the effects of the learning environment on students learning.

Studies on Differences in Classroom Perceptions of Male and Female Students:

Students' perceptions of the classroom environment have been used as criterion variables in the investigations of differences between perceptions of the classroom environment held by girls and boys. Studies into differences in the way in which boys and girls perceive their classroom environments have revealed that boys and girls typically prefer different types of learning environments. Owens and Straton (1980) found that girls, preferred more competition than boys. Yet in another similar study, it was found that boys, preferred more friction, competitiveness and differentiation

while girls prefer more teacher structure, personalisation and participation than did boys (Byrne, Hattie & Fraser, 1986).

Although differences in perceptions of learning environments of different sexes were reported in these studies, reasons for these differences were not explained. This study in India went beyond past research to understand and explain these gender differences, by enriching the understanding through the use of qualitative data.

Studies using Cross-Cultural Comparisons:

Cross-cultural comparisons refer to those studies, which employ and examine two or more cultures and societies (Brislin, 1983). The goals of cross-cultural research, according to Berry (1980), are three fold. Firstly, they seek to understand the relationship between cultural and behavioural variables. Secondly, they aim to identify the broad range of variables associated with human characteristics. Finally, they aim to check our own existing knowledge.

Cross-cultural comparisons have the potential to provide understanding of concepts as seen by the people within the culture under study, generating new insights (Brislin, 1983; Fraser, 1996; Stigler & Hiebert, 1997) and making possible the inclusion of the social context in which behaviours occur (Bilmes & Boggs, 1979, Tseng & Hsu, 1980). In education, cross-cultural studies have involved a variety of areas including: school effectiveness (Creemers, Reynolds, Stringfield, & Teddlie, 1996); educational achievement in mathematics (Lin, 1988; Stigler, Lee, Lucker & Stevenson, 1982) and reading (Reynolds & Farrell, 1996); concepts of science (Kawasaki, 1996); relationships between socialisation and achievement (Stevenson & Stigler, 1992); children's views of science (Yoshida, 1998); and power relationships (Spenser-Oatey, 1997).

A cross-cultural comparison was considered worth exploring in this study as there are many different cultural groups living in the city of Jammu. Because of the strategic location of this city, there has been constant migration into the city for the last 50

years, mostly due to political reasons, from the north (Kashmir) as well as the south (Punjab).

Studies on Associations between Classroom Environment and Student Outcomes:

According to Fraser (1986, 1991, 1994) a lot of learning environment research has involved the investigation of associations between students' cognitive and affective outcomes and their perceptions of the classroom environment. Reviews of these studies have indicated that students' perceptions of the classroom environment consistently account for considerable variance in student outcomes (Cheng, 1994; Fisher, Henderson & Fraser, 1997; Fraser & Fisher, 1982a, 1982b; Henderson, Fisher & Fraser, 1995; Idris & Fraser, 1997; McRobbie & Fraser, 1993; Wong & Fraser, 1994). The general implication of these studies is that student outcomes can be improved by enhancing the classroom environment.

Meta-analyses have been undertaken to bring together the findings of past research (Fraser, Walberg, Welch, & Hattie 1987; Walberg & Haertel, 1981). The strength of these studies lie in the inclusion of different countries, grade levels and subject matters. In each case, the studies have revealed that learning post-test scores and regression adjusted gains in student affective and cognitive outcomes are consistently associated with the classroom environment. It was also found that the correlations are generally higher for samples of older students and for studies that used groups as the unit of analysis. These studies have shown that better student outcomes are associated with greater cohesiveness, satisfaction and goal direction and less disorganisation and friction in the classroom environment (Haertel, Walberg, & Haertel, 1981).

These studies provide data on associations between the classroom environment and student outcomes but have not explored the causal relationships. An additional weakness is that many of these studies fail to address problems associated with the level of analysis, which affects both the interpretation of data and the magnitude of relationships between variables (Bock, 1989; Bryk & Raudenbush 1992; Fraser, 1998a, 1998b). Goh, Young, and Fraser (1995) and Wong, Young, and Fraser (1997)

have tried to deal with this problem through multilevel analysis by comparing the results of multiple regression analysis with those from an analysis involving the hierarchical linear model. Each of the two studies, one involving high school chemistry students using the SLEI (Wong, Young & Fraser, 1997) and the other involving primary school students using a modified version of the MCI (Goh, Young & Fraser, 1995), reported statistically significant results from the multiple regression analysis that were replicated in the HLM analysis. The present study has also used multiple regression analysis and qualitative data.

Studies using Qualitative or Combining Qualitative and Quantitative data:

Qualitative methods on their own or in combination with quantitative methods have been used in past learning environment research. One such qualitative study investigated the types of learning environments that teachers could create to promote success with students who have Attention Deficit Hyperactivity Disorder (Anstine-Templeton, 1994). The study suggested that, first, the learning environment needs to be structured in ways that will ensure success (such as routines with only a few steps) and second, teachers need to be treated as professionals in order to provide them with a positive self image that will aid reform.

In the past, studies in the field of learning environments have also used qualitative research methods or combined qualitative and quantitative research methods. Both the research methods are combined to complement and member-check the findings. Aldridge, Fraser, and Huang, (1999) combined qualitative and quantitative methods to explore the nature of classroom environments in a cross-national study involving Taiwan and Australia. The comparative nature of this study made it possible to investigate the differences in learning environments in each country. The authors stressed that the use of multiple research methods helped the researchers understand better the different aspects of the classroom environments. They concluded by saying that each country has much to learn from the other with regard to the development of a learning environment that fosters positive attitudes and a love for learning.

In another study, Anstine-Templeton and Nyberg (1997) did a case study in which they described and evaluated the environment that an exemplary teacher created. In this study they suggested, that the role of the teacher needs to be redefined so that it reflects the teacher as educational leader and informed decision maker. In doing so, teachers feel valued and rewarded for contributing beyond their classrooms.

Qualitative and quantitative methods were combined in a study which involved intensive gathering of quantitative data from two grade 10 classes for a period of 13 weeks and this further complemented by qualitative data (Tobin, Kahle, & Fraser, 1990). The qualitative data included daily interviews with two teachers and their students in addition to classroom observations. When used alongside the quantitative data, collected using questionnaires, students' perceptions of the learning environment were found to be consistent with observers' field notes of the patterns of the learning activities and engagement in each class.

Tobin and McRobbie (1996) investigated the performance of Chinese-Australian students in chemistry classes. They followed the hermeneutic approach whereby their learning was informed by their own research, learning from the field and their reading of the related literature. Observations and students' and teachers' responses to the questionnaire served as focal points for interviews to provide a general understanding of what the class was like.

Anstine-Templeton and Jensen (1993) combined qualitative and qualitative methods in yet another study, while examining the perceptions of exemplary teacher about their school environment. This study suggested that exemplary teachers influenced their school climates in positive ways. It also indicated that teachers facilitated positive school environments through empowering students to learn.

Classrooms of exemplary teachers were compared to that of non-exemplary teachers in another study combining qualitative and quantitative methods (Fraser & Tobin, 1989). In this study, main data were collected by qualitative means that is observations, interviews with teachers and students, and case studies. However, the same data were further enriched by quantitative data obtained through a

questionnaire. The findings of this study suggested that, first, exemplary and non-exemplary teachers could be distinguished in terms of their students' perceptions of the learning environment they created and, second, exemplary students' perceptions of the learning environment that the exemplary teachers created was more favourable than for students of non-exemplary teachers.

The notion of 'grain size', that is, focusing on different levels of intensity or extent (Fraser, 2000) was considered while studying ten science classes taught by the same teacher. Qualitative information was gathered from a variety of sources including student diaries, interviews and videotapes of the activities. The quantitative data were obtained by administering a modified version of the Constructivist Learning Environment Survey to three sub groups: first a selection of students in classes being studied: second a selection of students from other teachers in the same school; and third a larger representative group. These data were used for comparisons to find out the extent to which the teacher was typical of her school and the state. The overall pattern indicated differences between the perceptions of students in this teacher's class and the perceptions of students the in comparison groups.

Qualitative and quantitative methods of data collection were employed by Khalid (2003) while accessing the perception of mathematics classroom environments of technical students in Brunei Darussalam. Although, overall, the actual learning environment was favourable, the students still preferred a more enhanced environment. The greatest difference in actual preferred perceptions was for the scales of Involvement and Task Orientation.

The present study used the WIHIC questionnaire as the primary quantitative data collection tool for investigating the perceptions of high school students about their existing learning environments. In the next section, previous studies in which the WIHIC has been used are discussed.

Studies Using the WIHIC:

Chionh and Fraser (1998) reported on the validation of the primary version of the WIHIC in three countries namely, Australia, Singapore and Taiwan. The study

advocates the use of a widely-applicable, parsimonious, valid and economical instrument for future research in assessing students' perceptions of their classroom learning environments. The robustness and wide applicability of the WIHIC was supported by validity and reliability data for the use of the questionnaire in three different countries (Singapore, Australia and Taiwan), in two different languages (English and Chinese), in Actual and a Preferred forms, and in Class and Personal forms.

Aldridge, Fraser, and Huang (2000) used the WIHIC to study the cross-cultural high school science classroom environments in Taiwan and Australia. In this study, educational critique was used to describe the social and cultural factors that could influence the prevailing learning environments in each country. The findings of the study provided tentative explanations for differences and similarities between the learning environments of Australia and Taiwan.

A study by Rawnsley and Fisher (1998) investigated associations between learning environments in mathematics classrooms and students' attitudes towards that subject in Australia using the WIHIC questionnaire. It was found that students developed more positive attitudes towards their mathematics in classes where the teacher was perceived to be highly supportive, equitable, and in which the teacher involved them in investigation.

A study by Khoo and Fraser (1998) used a modified version of the WIHIC to measure classroom environment in evaluating adult computer courses. It was found that males perceived significantly greater involvement while females, at the same time, perceived significantly higher levels of equity. Gender related differences about the perceptions of the learning environment were also explored by Kim, Fraser, and Fisher (2000) in Korea. It was reported that boys perceived more teacher support, involvement, investigation, task orientation, and equity than did the girls.

Khine and Fisher (2001) employed the WIHIC to study the associations between students' perceptions of science classrooms learning environments, their attitudinal outcomes and the cultural backgrounds of their teachers. The results of this study showed that students perceived a more favourable learning environment in the classrooms of the Western teachers. Students perceived that Western teachers were more cohesive, supportive, cooperative, involving, task oriented and maintained better equity among the students.

A modified version of the WIHIC was administered to 1,400 students in Indonesia to assess the existing classroom learning environments in that country and their associations with students attitudes towards science and national examination scores (Wahyudi & Treagust, 2003) The findings of this study replicated the findings of previous studies. The researcher commented that these findings should be used as a starting point for improving the science teaching-learning processes in Indonesia.

In yet another attempt to validate the WIHIC in schools in the USA, the questionnaire was administered on a large scale to eighth grade students (Rickards, et.al, 2003). Results indicate that some scales of the WIHIC are more inclined to measure personal, idiosyncratic features of the students' perceptions of their learning environments, whereas other scales contain more variance at the class level. On average, girls perceived their learning environment more positively than did boys.

Although, many studies have been carried out to examine and report on the existing learning environments in various countries, there is no evidence that any such study has ever been carried out in India other than the study carried out to validate a learning environment instrument in Hindi (Walberg, Singh, & Rasher, 1977). With the rapid development of science and technology it is expected that the classroom environments must have changed in the past 26 years in India also, therefore, there is a need for a study to be undertaken in India. In the present study, the WIHIC questionnaire was used to examine the existing perceptions of the students of their classroom learning environments in India. However, it was considered that the

interactions between teachers and students is a significant aspect of the classroom learning environment and would add to the description of the classrooms. This aspect is explored in the following section.

2.5 STUDY OF TEACHER-STUDENT INTERACTION

2.5.1 Historical Background

One of the earliest attempts to categorise and observe interaction in the classroom with the use of the trained observers who recorded verbal elements of the interaction in the classroom was carried out by Withall (1949). The seven different categories in which Withall categorised the interaction behaviour are learner-supportive statements, acceptance and clarifying statements, problem-structuring statements, neutral statements, directive and authoritative statements, reproving or deprecating remarks and teacher self-supporting remarks. The first three categories were classified as learner centred and last three as teacher centred, while the middle one was neutral (Hargreaves, 1972). The work continued by Withall and Flanders had lot of similarities and was designed to represent teacher-student interaction (Hargreaves, 1972).

In the 1970s, Wubbels, Creton, and Hooymayers (1987) were involved in a long-term research project named *Education for Teachers* at the University of Utrecht in The Netherlands. This project can be classified as a pioneer and thought provoking study in the field of teacher-student interpersonal behaviour research (Wubbels & Levy, 1993). The main aim of this study was to apply the research findings, in the form of a school induction programme, to the experiences of pre-school teachers. One of the earliest findings of this study revealed that the main factor, giving rise to the discipline problems was interpersonal teacher behaviour. These findings were based on observations, analysis of interviews, conferences and action research (Wubbels, Creton, & Hooymayers, 1992). This pioneer study in The Netherlands provided a basis for the current study, where interpersonal behaviour between teachers and students is studied.

Leary's Model For Interpersonal Behaviour

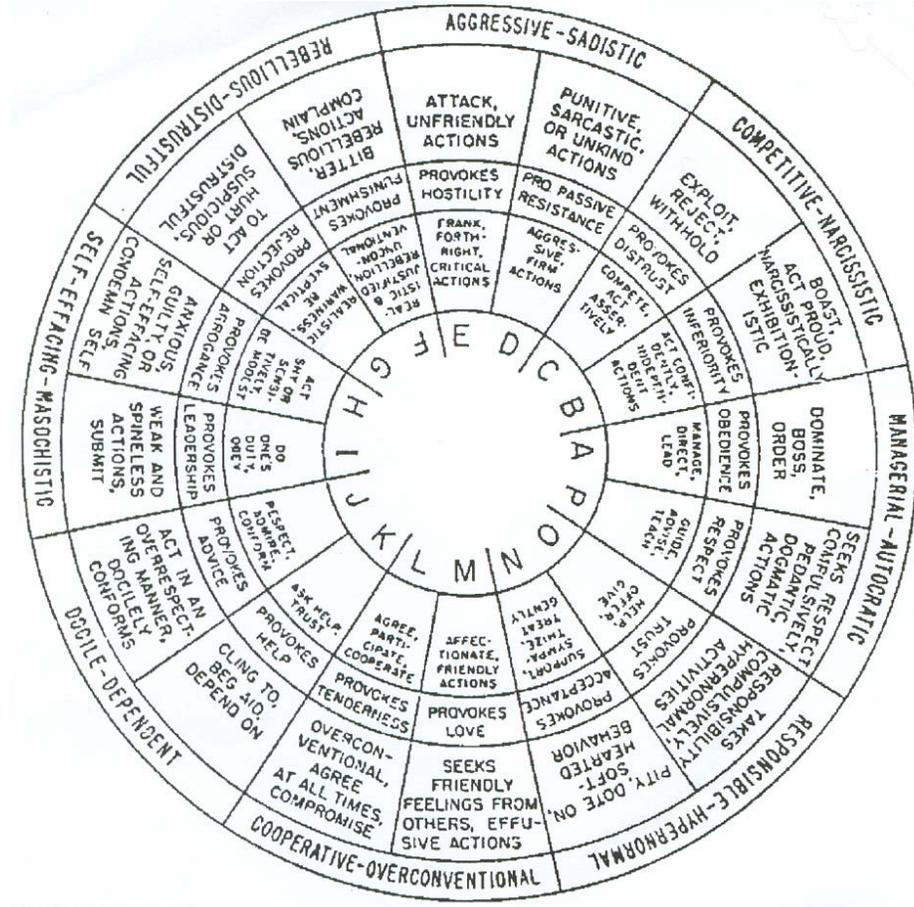


Figure 2.1. Classification of interpersonal behaviour into sixteen mechanisms or reflexes. (Source: Leary, 1957, p.65)

Leary and his colleagues, while working on a project named *Kaiser Foundation Research Project* developed a model of interpersonal behaviour (Leary. 1957, p. 62). This development suggested a 16-dimensional model with two levels of behaviour. The level one behavioural dimensions were classified in terms of interpersonal mechanisms, gestures or reflexes and involved two-way interpersonal codes, see Figure 2.1.

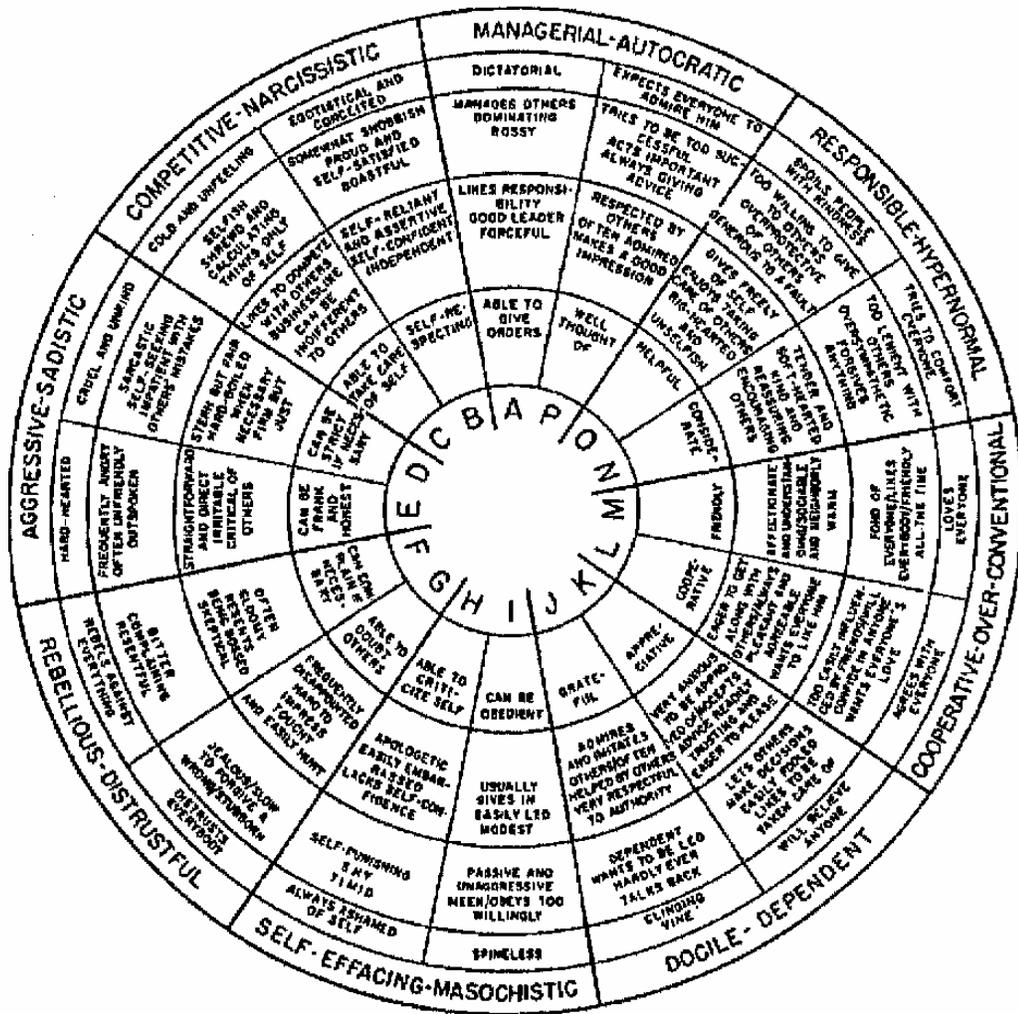


Figure 2.2. Level two classification of the interpersonal behaviours into sixteen variable categories. (Source Leary, 1957, p.135)

Level two behaviours were classified into interpersonal attributes or traits, see Figure 2.2. The interpersonal behaviour was conceptualised as two intersecting dimensions of love-hate and dominate-submit dimensions. According to Leary, "every discernible or rateable interpersonal theme in the content of an individual's verbalisations defines a unit of Level two behaviour" (p. 135).

The model assumes that interpersonal behaviour is motivated by an individual's needs to reduce anxiety and maintain self-esteem (Leary, 1957). According to Leary, if an individual repeats interpersonal behaviours that reduce anxiety and increase or maintain self-esteem, then a pattern of communication behaviour is established. He further suggested that the "motivating principle of behaviour" for individuals is "the avoidance of greater anxiety and the selection of the lesser anxiety". This theory is in accordance with the systems perspective that suggests that circular communication processes develop, which not only consist of behaviour, but determine behaviour as well (Creton, Wubbels, & Hooymayers, 1993). The 16 categories suggested by Leary and his colleagues were later reduced to eight categories of interpersonal behaviour, which can be seen in Figure 2.3 (Wubbels, Creton, Levy, & Hooymayers, 1993).

This two-dimensional coordinate system of representing interpersonal behaviour mapped the degree of cooperation between the individuals communicating on the horizontal axis and the degree of the control or influence over the communication process of the communicator being observed on the vertical axis. Leary originally labelled the Cooperation-Opposition axis the "Affection-Hostility" continuum (Wubbels, Creton, Levy, & Hooymayers, 1993).

Although the Leary's model was an adequate model to represent interaction behaviour and withstood testing in psychological research settings (Wubbels, Creton, Levy, & Hooymayers, 1993), the 128-item Interpersonal Adjective Checklist (IAC) that Leary used to gather his data about four levels of behavioural intensity was cumbersome in an educational setting, (Wubbels, Creton, Levy, & Hooymayers, 1993) and contained many items which were not pertinent to teachers

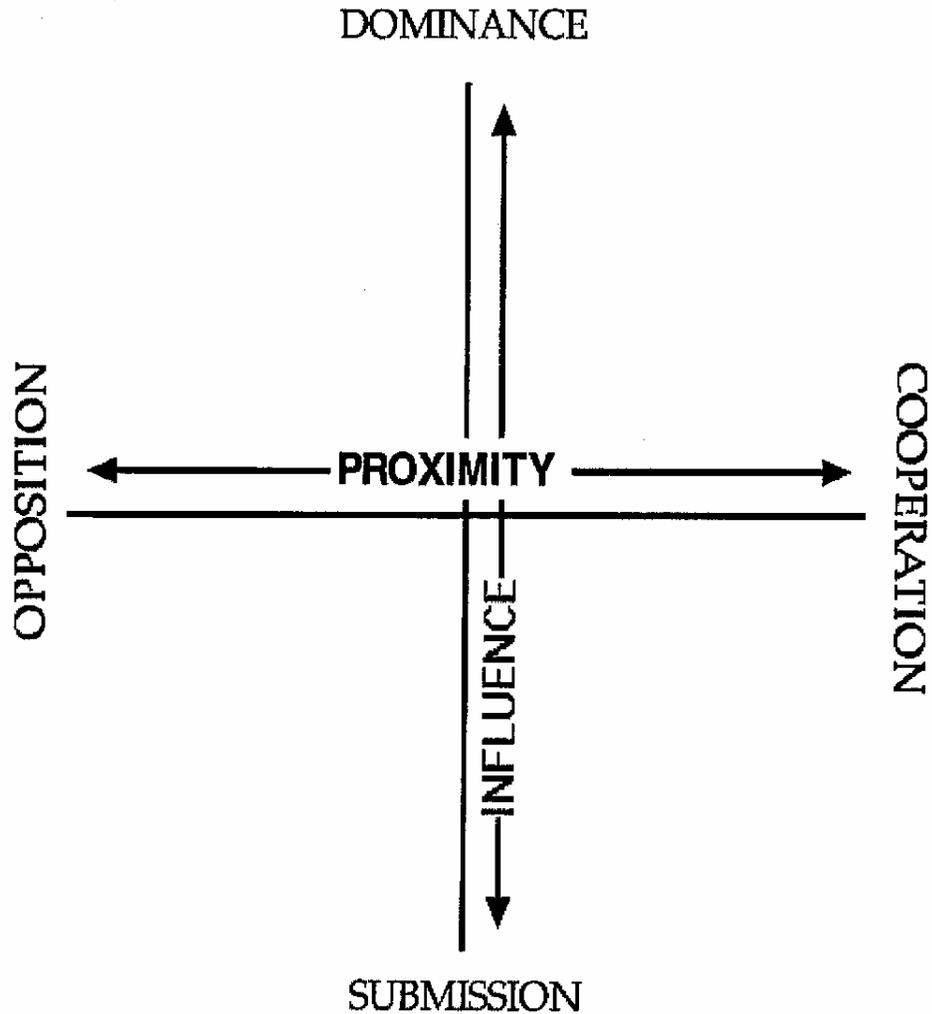


Figure 2.3. The two-dimensional coordinate system of the Leary model. (Source: Wubbles, Creton, Levy, & Hooymayers 1993, p. 15).

This two-dimensional model based on the work of Leary (1957) has been extensively used in educational research (Wubbels, Creton, Levy, & Hooymayers, 1993). At the same time some other tools for measuring human interaction were also developed and used (see Figure 2.3). For example, the terms used included Status and Solidarity (Brown, 1965, 1985), Warmth and Directivity (Dunkin & Biddle, 1974), and Dominance and Affiliation (Foa, 1961; Gough, 1957). Despite the availability of these other scales Leary's terms of influence and proximity have generally been accepted as universal descriptors of human interaction (Wubbels, Creton, Levy, & Hooymayers, 1993).

2.5.2 The Development of the Model for Interpersonal Teacher Behaviour

The two dimensional coordinate system of Leary's model has two consecutive behaviours prevailing upon each other in the same quadrant. For example, dominance and cooperation DC as well as cooperation and dominance CD can be seen in the same quadrant (Figure 2.4). This represents the prevalence of the first behavioural attribute over the latter one as exhibited by the teacher in the classroom. The difficulty with this two-dimensional model was of exhibiting two conflicting behaviours in the same quadrant, such as when opposition and submission are plotted in the same quadrant. This limitation might have led to the modification of the two-dimensional model given by Leary into a more comprehensive one.

The model for interpersonal teacher behaviour (Wubbels & Levy, 1993) has been adapted from Leary's model. In this model teacher behaviour is mapped with the Proximity dimension (Cooperation, C - Opposition, O) and the Influence dimension (Dominance, D - Submission, S) to form eight sectors, each describing different behaviour aspects. The sections in the model for interpersonal teacher behaviour are labelled DC, CD, CS, SC, SO, OS, OD and DO according to their position in the coordinate system. For example, the two sectors DC and CD are both characterised by Dominance and Cooperation. In the DC sector, however, the Dominance aspect predominates over the Cooperation aspect, whereas the adjacent sector CD Cooperation predominates over the Dominance aspect.

These modified behavioural aspects were labelled Leadership, Helping/Friendly, Understanding, Student Responsibility/Freedom, Uncertain, Dissatisfied, Admonishing and Strict behaviour.

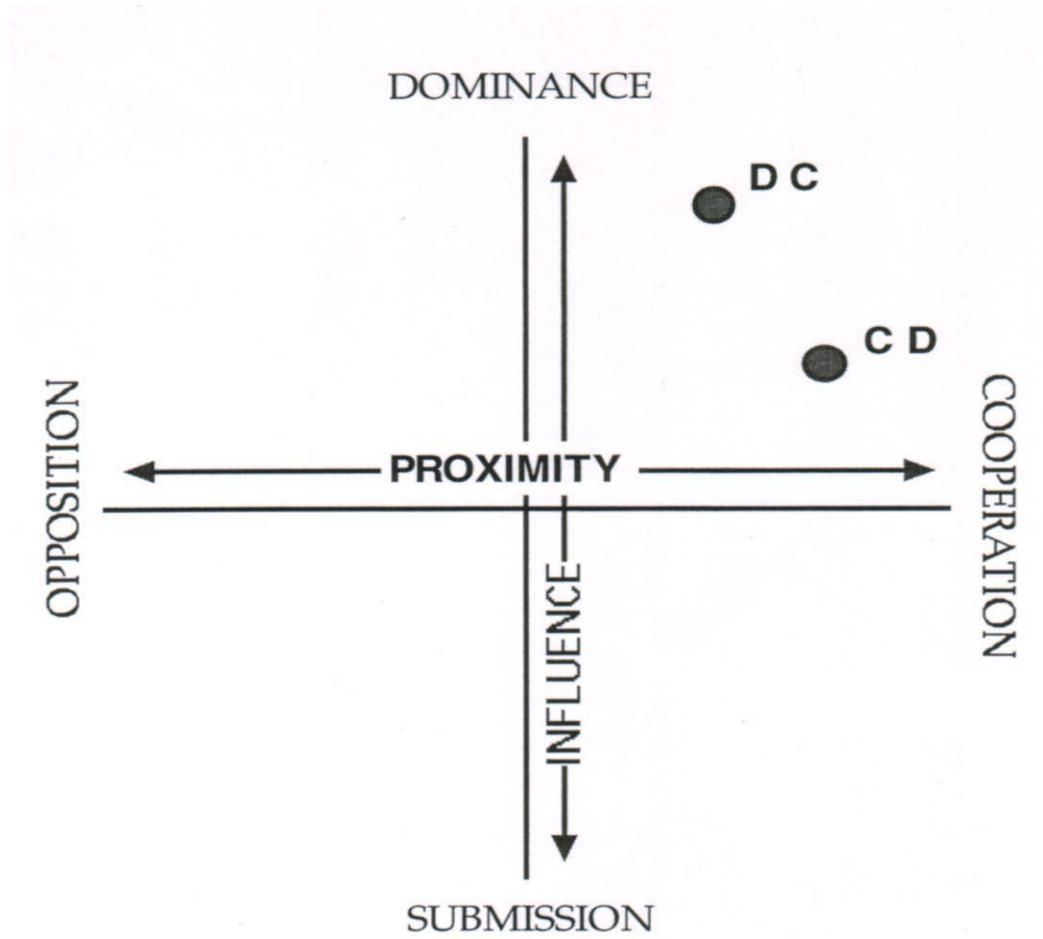


Figure 2.4. The two-dimensional coordinate system of the Leary model (Source: Wubbels, Créton, Levy, & Hooymayers, 1993, p. 15).

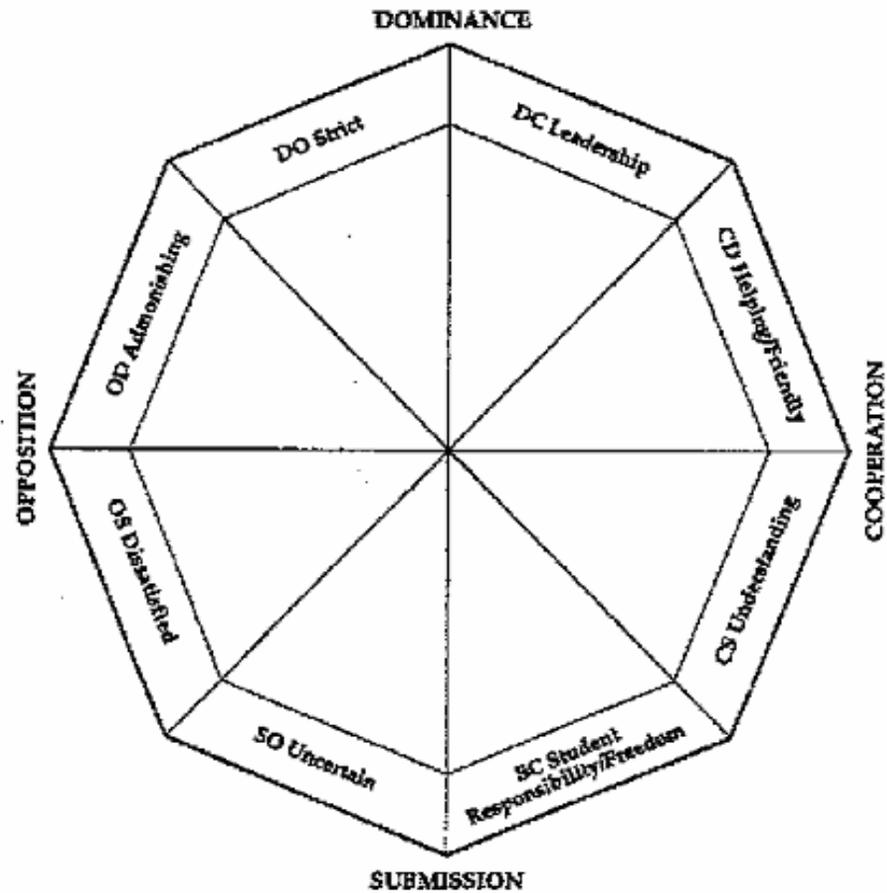


Figure 2.5 The model for interpersonal teacher behaviour. (Source: Fisher, Fraser, & Wubbels, 1993).

The non applicability and non feasibility of Leary's model to the educational settings paved the way to the development of the *Questionnaire for Interactional Teacher-behaviour* (Wubbels, Creton, & Hooymayers, 1985) and later the *Questionnaire on Teacher Interaction* (QTI) (Wubbels & Levy, 1993).

2.5.3 The Development of the Questionnaire on Teacher Interaction (QTI)

The Questionnaire on Teacher Interaction has been extensively used in educational research at an international level and its utility has been well established. in the literature (Brekelmans, Wubbels, & Creton, 1990; den Brok, Levy, Rodriguez, &

Wubbels, 2002; Fisher, Fraser, & Rickards, 1997; Fisher, Henderson, & Fraser, 1995; Gorham & Zakahi, 1990; Hecht, Andersen, & Ribeau, 1989; Levy, Rodriguez, & Wubbels, 1992; Rickards & Fisher, 1998; Scott & Fisher, 2000; Wubbels, Brekelmans, & Hermans, 1987; Wubbels, Brekelmans, & Hooymayers, 1991; Wubbels, Creton, & Hooymayers, 1985; Wubbels & Levy, 1991; Wubbels & Levy, 1993,). The QTI has been the focus of well over 120 (learning environment) studies in many countries (den Brok, Brekelmans, Levy, & Wubbels, 2002) and has been translated into more than 15 languages (Wubbels, Brekelmans, van Tartwijk, & Admiraal, 1997).

An instrument was required at lower secondary school science classes, to measure teacher-student interpersonal behaviour. This gave rise to a multi-scale instrument having good internal consistency within scales and is able to differentiate between student perceptions in different classrooms. In this section the history and development of the teacher-student interpersonal behaviour questionnaire, the QTI is discussed. The various forms of the QTI and its use in past research have also been discussed in brief.

The studies using the QTI as an instrument have demonstrated that the nature of relationship between teacher and his/her students is an important aspect of the learning environment (Fraser & Walberg, 1991) and despite being a very recent instrument the behaviour patterns that are established in a classroom learning environment are relatively stable over time (Brekelmans, Holvast, & van Tartwijk, 1990; Fraser & Walberg, 1991). Creton, Wubbels, and Hooymayers (1993), Wubbels, Creton, and Holvast, (1988) and Fraser (1991) suggested that the circular communication processes that consist of behaviour as well as determine behaviour develop early in the year in a classroom. Once these behaviours have been developed and stability has been achieved in the classroom both students as well as teachers resist change.

It has been suggested that students and teacher should have interacted at least for a period of two to three months prior to the administration of the QTI to a target group as the items ask questions about the teacher's behaviour over a long period of time, not just during the current lesson (Brekelmans, 1989; van Tartwijk, Brekelmans, & Wubbels, 1993). It is also assumed that the nature and patterns of the teacher-student interpersonal behaviour that are established during this time are very likely to remain relatively stable for the remainder of the year (Fraser & Walberg, 1991). This conveys that the student teacher interaction nature and patterns will remain the same if the questionnaire is administered after the initial two to three months settling-in period (Brekelmans, 1989). However, for the study described in this thesis the survey data were collected towards the end of the academic session when students and teacher interaction patterns were well established.

The QTI (Wubbels & Levy, 1991; 1993) was designed to assess teacher-student interpersonal behaviour in lower secondary classroom and developed out of a need to measure secondary students' and teachers' perceptions of teacher behaviour. In early 1980s, the original version of the QTI in Dutch language was developed in four trials in The Netherlands and had 77 items, which were arranged in the eight scales corresponding to the eight sections of the model for interpersonal teacher behaviour (Wubbels, Creton, Levy, & Hooymayers, 1993). Nine to eleven items were included in each of the eight scales. These 77 items were derived from the 128 items the ICL (Wubbel, Creton, & Hooymayers, 1992) and later these 128 items were modified, reworded and finally reduced to 77 items. The other change made from the ICL was change of response from 'yes' or 'no' to a five point Likert type response. Later, an American version of the QTI was developed in the English language, and had 64 items (Wubbels & Levy, 1991). The items deleted from the Dutch version were on the basis of correlational analysis of the 77-item version to 64 items in the American version.

An Australian version of 48 items followed these two pioneering versions of the QTI (Fisher, Fraser, & Wubbels (1993). This shorter version has six items in each of the eight scales.

Table 2.2. Represents, the nature of the QTI by providing a scale description and a sample item for each of the eight scales. This 48-item, economical, practical, Australian version of the QTI was used for this study in addition to the WIHIC and the attitude scale, which are discussed in this chapter in section 2.4 and section 2.6.

Table 2.2:

Description and Example Items for Each Scale in the QTI

Scale	Description	Item
Leadership [DC]	Extent to which teacher provides leadership to class and holds student attention.	This teacher explains things clearly.
Helping/ Friendly [CD]	Extent to which the teacher is friendly and helpful towards students.	This teacher is friendly.
Understanding [CS]	Extent to which teacher shows understanding and care to students.	If we don't agree with this teacher, we can talk about it.
Student Responsibility/Freedom [SC]	Extent to which the students are given opportunities to assume responsibilities for their own activities.	We can influence this teacher.
Uncertain [SO]	Extent to which teacher exhibits her/his uncertainty.	This teacher seems uncertain.
Dissatisfied [OS]	Extent to which teacher shows unhappiness/dissatisfaction with the students.	This teacher thinks that we don't know anything.
Admonishing [OD]	Extent to which the teacher shows anger/temper and is impatient in class	This teacher gets angry.
Strict [DO]	Extent to which the teacher is strict with demands of the students.	We are afraid of this teacher.

Responses to the items are scored 1,2,3,4,5 respectively, for the responses Almost Never, Seldom, Sometimes, Often, Almost Always. Missing or invalid responses are scored 2, the midrange value. A copy of the Questionnaire used in the study can be seen in Appendix 1.

Responses to all the versions of the QTI items are recorded on a five point Likert type response scale scoring from 1 (Almost Never) to 5 (Almost Always) on the questionnaire only. The use of a separate response sheet is not practised with this instrument, and thus reducing the time in responding and facilitating the easy quick administration of the QTI within one lesson.

From the administration of the QTI to students, we get information about the perceptions of the teachers and the perceptions of their students of the interpersonal behaviour of that teacher. In the same manner when administered to teachers we get information about teachers' perceptions of their own behaviour or the behaviour they consider ideal. However, in this study only the student version of the actual QTI was used.

All the 48-items of the Australian version of the QTI are arranged consistently in cyclic order and in blocks of four. This is clearly indicated in Appendix C. Items 1-24 assess the four scales called Leadership, Understanding, Uncertain, and Admonishing, whereas items 25-48 assess the scales of Helping/Friendly, Students Responsibility and Freedom, Dissatisfied, and Strict.

In addition to the three forms of the QTI already discussed a primary level version of the QTI has been developed, trialed and validated in Singapore (Goh & Fraser, 1995; Goh & Fraser, 1996; Goh, Young, & Fraser, 1995). This version has been adapted from the 48-item QTI in order to be more readable for the younger students and has a revised three-point response format. Further to this another modification of the QTI has resulted in the *Principal Interaction Questionnaire* (PIQ) (Cresswell & Fisher, 1997). This questionnaire assesses the teachers' or school principals' perceptions of principal interpersonal behaviour using the same eight scales of the QTI.

2.5.4 Review of Literature on Teacher Student Interactions

Studies in Australia:

Fisher, Fraser, & Wubbels in one of the first uses of the QTI investigated associations between teachers' perceptions of their work environment using the *School Level Environment Questionnaire* (SLEQ), (Fisher & Fraser, 1990) and students' and teachers' perceptions of their classroom interactions using the QTI. The relationships between the SLEQ and the QTI were generally weak in the results of this study. This suggests that teachers believed that they had considerable autonomy and freedom to shape their own classrooms regardless of their school environment. It could be the case where the teacher thought, when the door was shut in the class, it was her/his class.

The QTI was used on a sample of 792 students and 46 teachers in the states of Western Australia and Tasmania (Fisher, Fraser, & Wubbels, 1993; Fisher, Fraser, Wubbels, & Bekelmans, 1993). The results of the study revealed that, generally, teachers did not reach their ideal and differed from the best teachers as perceived by students. Students perceived that the best teachers are strong leaders, more friendly and understanding, and less uncertain, dissatisfied and admonishing than are teachers on average. This pilot study strongly supported the validity and the potential usefulness of the QTI in Australia. Further comprehensive research using the QTI was also advocated.

Keeping the past tradition of learning environment research in mind (Fraser, 1992; Fraser & Fisher, 1982) it is important to establish how teacher-student interpersonal behaviour affects student outcomes. The first use of the 48-item QTI was carried out by a team of researchers who studied 489 students in 28 biology classes in senior high school (Fisher, Henderson, & Fraser, 1995). The three distinct student outcomes included in this study were student attitude, achievement in a written examination and performance on practical tests. Few studies before this had investigated the

associations between students' perception of teacher-student interactions in science classes and student outcomes.

The validity and reliability of the QTI when used with senior secondary students was confirmed in this study. The alpha reliability scores for the different QTI scales ranged from 0.63 to 0.83 when the individual student was used as the unit of analysis (Fisher, Henderson, & Fraser, 1995). The reliability scores were higher when the class mean was used as the unit of analysis ranging from 0.74 to 0.95. Generally, the dimensions of the QTI were found to be associated significantly with student attitude scores. In particular, students' attitude scores were higher in classrooms in which students perceived greater leadership, helping/friendly, and understanding in their teachers' interpersonal behaviours. On the contrary, students' attitude scores were lower in classrooms in which students perceived greater uncertainty, dissatisfaction, admonishing, and strictness in their teachers' interpersonal behaviours. This study reported that a biology teacher should ensure the presence of these interpersonal behaviours to promote favourable student attitudes to their class and laboratory work.

Another study using the QTI in Australia examined students' attitudes to mathematics and teacher-student interpersonal behaviour in mathematics classrooms (Fisher & Rickards, 1998). This confirmed the reliability of the QTI when used with a sample of 405 students in nine schools together with their 21 grade 8, 9, and 10 Mathematics teachers. Student attitude scores were consistent with those found in science classrooms and were higher in classrooms in which students perceived greater leadership and, helping/friendly behaviours in their teachers' interpersonal behaviours and lower in classrooms in which students perceived greater dissatisfaction, admonishing, and strictness in their teachers' interpersonal behaviours.

Another study used the QTI and the *Myers-Briggs Type Indicator* (MBTI) (Myers & McCaulley, 1985). This study was inspired by Lewin's formula $B=f(P,E)$. In this study, 1,883 grade 11 and 12 students from 108 classes in Tasmania, Australia were

involved (Fisher, Kent, & Fraser, 1997, 1998; Kent & Fisher, 1997; Kent, Fisher, & Fraser, 1995). The QTI was used to measure the “E” or environment element of the formula. The study examined the teacher perceptions of the interpersonal behaviour, the relationship between teacher-student interpersonal behaviour, measured with the QTI, and the teacher personality type, measured by the MBTI and the percentages of each personality type in the sample. Cronbach alpha reliabilities of the scales of the QTI reported in this study ranged from 0.66 to 0.83 when the individual student was used as the unit of analysis. When the more conservative class mean score was used as the unit of analysis, reliabilities ranged from 0.83 to 0.93. This study reported that there was a moderate association between teacher-student interpersonal behaviour and teacher personality. Teachers’ self-perception and teacher personality were more closely associated than student perceptions of teacher interpersonal behaviour and teacher personality.

Rickards and den Brok (2003) reported on a study where the QTI was used on a large sample of Australian secondary students and teachers to investigate the students perception of two important dimensions of the teacher namely, influence (dominance vs. submission) and proximity (cooperation vs. opposition). This study aimed at multilevel analysis in addition to associations between teacher interaction and student gender, student and class ethnic background and subject taught reported on the effect of student class attitude and effect of class size on student’s perception.

Rickards, den Brok and Fisher (2003) constructed a large data set out of several prior studies using the QTI in four different states of Australia in the past decade. The main aim of this study was to develop a typology of interpersonal behaviour of an Australian teacher. More than 85% of the teachers were classified as either being directive, authoritative or tolerant-authoritative. Uncertain-tolerant, uncertain-aggressive and repressive teachers were hardly found in the Australian sample.

All these studies reviewed in section 2.4.4 were completed in Australia and in the next section studies carried out using the QTI in other countries are discussed.

Studies in Other Countries:

Wubbels and Levy (1993) reported the validity and reliability of the QTI when used in The Netherlands. The 64-item American version of the QTI was also used with 1,606 students and 66 teachers in the USA, and the cross-cultural validity and usefulness of the QTI were confirmed (Wubbels & Levy, 1991).

Studies in Singapore (Goh & Fraser, 1995), Israel (Kremer-Hayon & Wubbels, 1992) and Brunei (Riah, Fraser, & Rickards, 1997; Rickards, Riah, & Fisher, 1997) have also confirmed the validity and reliability of the QTI. Wubbels and Levy (1991) using Cronbach alpha coefficient as a measure of how closely items in each of the QTI scales measured the same behaviour, found acceptable internal consistency reliabilities for the QTI scales ranging from 0.76 to 0.88 for student responses and from 0.74 to 0.84 for teacher responses in the USA. The Dutch data from the study (Wubbels & Levy, 1991) also contained internal consistency reliabilities for the QTI scales ranging from 0.74 to 0.90 for student responses. Furthermore, test and re-test reliabilities have been found to be above 0.80 (Wubbels, Brekelmans, & Hooymayers, 1991).

The review of literature regarding the QTI reveals that very few longitudinal studies have been carried out using the QTI, such as investigating changes in the interpersonal teacher behaviour during a teaching career. Creton, Hermans, and Wubbels (1990) reported on one such study and suggested that there was an increase in dominance behaviour and a corresponding decrease in uncertain behaviour and disorder in the classroom over time. These results are also detailed in a report on teacher interpersonal behaviour and the same changes in leadership and uncertain behaviours were evident as the teachers became more experienced up to about ten years of teaching (Brekelmans, Holvast, & van Tartwijk, 1990). Teacher interpersonal behaviour for leadership and uncertain behaviour then stabilises and there is no increase in cooperative behaviour as teacher experience increases (Brekelmans, Holvast, & van Tartwijk, 1990) Teachers have been found to become less helpful,

friendly and understanding and more admonishing and dissatisfied as the time increases (Creton, Hermans, & Wubbels, 1990).

In The Netherlands, differences in the perceptions of the teachers and students of the teacher interpersonal behaviour in the same learning environment was carried out using different school subjects (Brekelmans & Wubbels, 1992). The findings of the study reported that teachers and students tended not to agree about their perceptions of interpersonal behaviour.

The data collected from the studies in The Netherlands, the USA and Australia were analysed (Levy, Creton, & Wubbels, 1993), where students had been asked to rate their best and the worst teacher while using the QTI. The best teachers rated by the students were strong leaders, friendly and understanding. The outstanding feature of worst teachers, as rated by the students, was their increased admonishing and dissatisfied character. Although there were not many differences in the characteristics of Dutch and American teachers, when compared in this study (Wubbels & Levy, 1991), American teachers were still perceived as stricter and Dutch teachers as giving their students more responsibility and freedom.

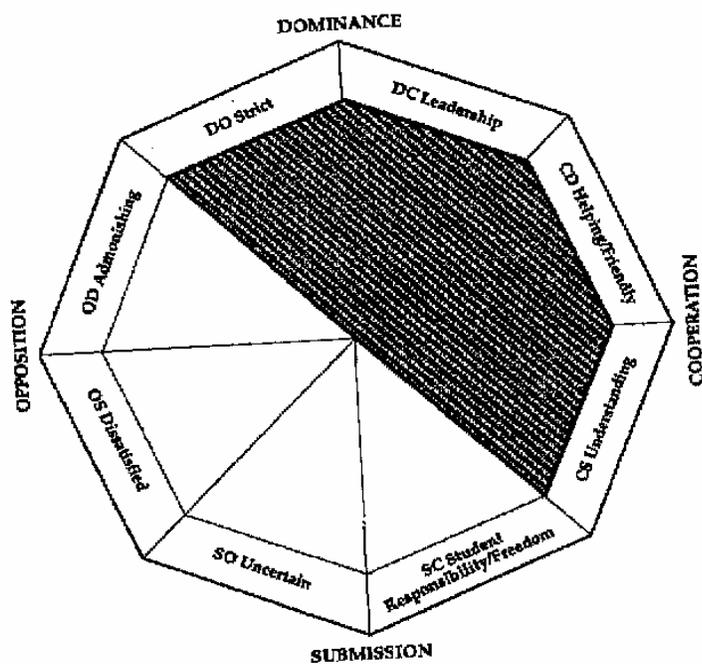


Figure 2.6. Associations between QTI scales and student cognitive outcomes.

The relationships between perceptions on the QTI scales and student outcomes were investigated in yet another study in The Netherlands (Wubbels, Brekelmans, & Hooymayers, 1991). The cognitive outcome scores of the students were greater where teachers demonstrated more strict, leadership and helping/friendly behaviour. On the other hand, student responsibility and freedom, uncertain and dissatisfied behaviours of teachers had adverse effects and a negative association with student cognitive outcomes. This can be illustrated as in Figure 2.6.

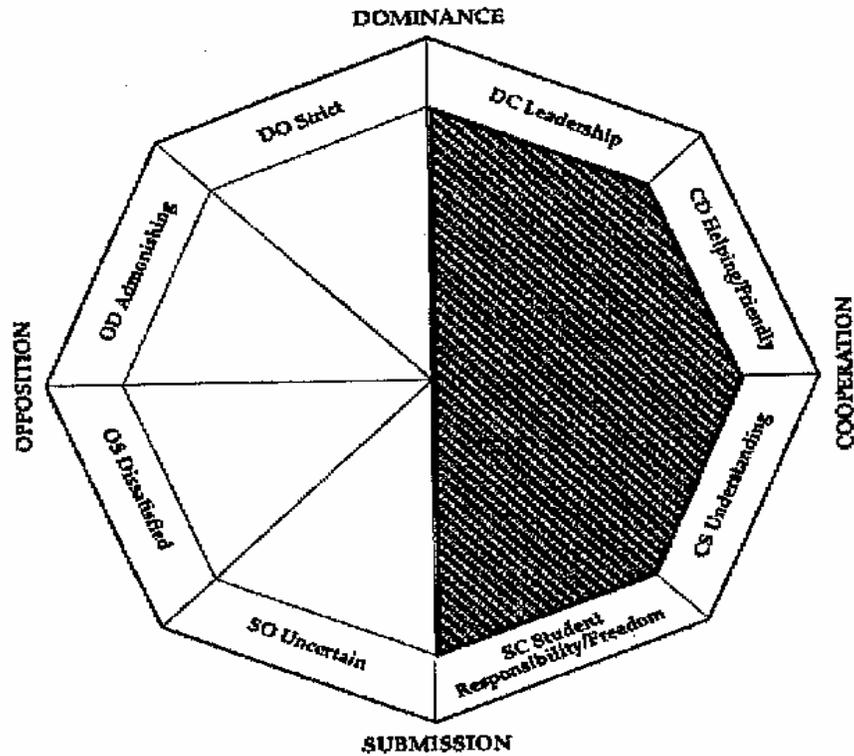


Figure 2.7. Associations between QTI scales and student attitudinal outcomes.

Teachers and students were examined in a study in Physics classes (Creton, Hermans, & Wubbels, 1990), where associations between teacher-student interpersonal behaviour in the classroom and students' affective outcomes were examined. Positive associations were found between the more cooperative behaviours (the scales of Student Responsibility and Freedom, Understanding, Helpful and Friendly and Leadership). In classes where more of these behaviours were exhibited by the teacher, students had higher affective outcomes. This is depicted in Figure 2.7.

These results indicate that the proximity dimension was more closely associated with student enjoyment of their Physics classes rather than the influence dimension. These findings are further supported by research with secondary school students in 1990 and university students in 1991 that concluded that effective teachers were those who had been nominated by the students, who had proceeded into post compulsory education, and were being especially helpful and encouraging (Holloway, 1994).

Variations in the students' appreciation of the subject and the lessons have been characterised on the basis of the proximity dimensions: the more cooperative the behaviour displayed, the higher the affective outcome scores (Wubbels, Brekelmans, & Hooymayers, 1991). That is, student responsibility and freedom, understanding, helping/friendly and leadership behaviours are related positively to student attitudes. Uncertain, dissatisfied, admonishing and strict behaviours are related negatively to student attitudes. Overall, previous studies have demonstrated that interpersonal teacher behaviour is an important aspect of the learning environment and that it is related strongly to student outcomes.

The QTI has also been used to develop typologies of teacher interpersonal behaviour in The Netherlands (Wubbels, Brekelmans, Creton, & Hooymayers, 1990). Using cluster analysis, eight types were distinguished. The behavioural patterns on the eight-teacher type were characterised as directive, authoritative, tolerant/authoritative, tolerant, uncertain/tolerant, uncertain/aggressive, repressive, and drudging. Teacher types of profiles from all American and Dutch studies can be associated with one of the typologies that have been identified above (Brekelmans, Levy, & Rodriguez, 1993). Teacher types associated with the greatest student cognitive and affective gains were directive (characterised by a well structured task oriented learning environment) and tolerant/authoritative (characterised by a pleasant well structured environment in which teacher has a good relationship with students). Uncertain/aggressive (characterised by an aggressive kind of disorder) and uncertain/tolerant teacher types were associated with the lowest student gains.

Associations between teacher-student interaction and student attitudes and achievement, have been suggested as a worthy area for research (Hargreaves, 1972). Flanders (1964) suggested that student achievement and attitude would be better in classrooms that were learner-centred as opposed to teacher-centred. In the following section reports on the studies about the associations between student perceptions of the teacher-student interpersonal behaviour, the sex of the student, and the outcome variables of attitude and achievement are discussed.

In a study conducted in America, it was reported that “student achievement is not a direct consequence of the social background or school attendance” (Green, Dugoni, Ingels, & Camburn, 1995) and that one indicator is student effort in the class. One review of predominantly low inference measure classroom environment studies (Rosenshine, 1971) found consistent but not strong correlations between teacher behaviours and student achievement. The pattern of courses taken also has an impact (Green, Dugoni, Ingels, & Camburn, 1995). Following a need for more research into associations between teacher behaviours and student achievement (Brophy & Good, 1986), it has been demonstrated internationally that students’ perceptions of the science classroom learning environment have been positively associated with student cognitive measures and student attitude to class (Fraser, 1991; Fraser, 1994; Fraser, Walberg, Welch & Hattie, 1987; Haertel, Walberg, & Haertel, 1979; Haertel, Walberg, & Hartel, 1981; McRobbie & Fraser, 1993). If education is to improve student outcomes and increase the positive interest of students in science these factors should be considered.

In the next section cross-national studies on teacher interpersonal behaviours are discussed.

Cross-National Studies:

In the last decade, there has been a lot of expansion and internationalisation in the presentation of science education research findings with special reference to the period from 1990 to 1995, (Fraser, 1997). The review of literature on education

environment reveals that, at least since the late 1970s, international learning environment research has been undertaken. Interest in cross national studies in science education in the recent past (Aldridge, Fraser, & Haung, 1998; Fisher, Goh, Wong, & Rickards, 1996; Fisher, Rickards, Goh & Wong, 1997; Riah, Fraser, & Rickards, 1997) and new international conferences further support the international growth and dissemination of research findings in this area. The renewed attention may be due in part to the international audience at conferences which may enhance cross-national research links (Fraser, 1997).

One of the earliest studies of interpersonal behaviour from a cross-national perspective (Wubbels & Levy, 1991) was carried out in The Netherlands and the USA. In this study an attempt was made to validate the English version of the QTI, and investigate if the Dutch and the English versions of the questionnaire were equivalent, and examine any differences in the students' or teachers' perceptions of interpersonal teacher behaviour in these two countries. The study found that teacher behaviours were similar in many ways but that American teachers saw strictness as being more important where as Dutch teachers emphasised student responsibility and freedom. According to Wubbels and Levy, this study was a first step towards cross-national research with the QTI and the comparisons with other variables such as student cultural background are enhanced by the availability of this new instrument. Although the primary aim of this study was to develop an English version of the Dutch QTI for use in an American setting, it did serve as an excellent ground for the future development of the Australian 48-item version of the QTI (Wubbels, 1993).

The QTI was also employed in a cross-national study in Singapore and Australia in 1997 (Fisher, Goh, Wong, & Rickards, 1996; Fisher, Rickards, Goh & Wong, 1997). The study involved 720 students in 20 grade 8 and 9 science classes Singapore and 705 students in 29 grade 8 and 9 science classes in Australia. In Singapore, the alpha reliability figures for different QTI scales ranged from 0.50 to 0.88 when the individual student was used as the unit of analysis, and from 0.60 to 0.98 when the class mean was used as the unit of analysis. For the Australian sample, the

corresponding values were 0.60 to 0.88 and 0.64 to 0.96, respectively (Fisher, Rickards, Goh, & Wong, 1997). The results for this sample generally provided further cross-validation information supporting the internal consistency of the QTI with either the individual student or the class mean as the unit of analysis. The Student Responsibility/Freedom scale had reliability figures less than the other scales, particularly in Singapore, and it was suggested that this scale requires examination and revision before being used in that country.

Another cross-national study was conducted in Brunei and Australia (Rickards, Riah, & Fisher, 1997). In this study the QTI was found to be a valid and reliable instrument. Reliabilities for the scales of the QTI when used in Brunei were found to be acceptable and ranged from 0.58 to 0.80 when the individual student was used as the unit of analysis. These data were then applied to a cross-national study, which provided an Australian sample of secondary science classrooms. Reliabilities for the QTI scales ranged from 0.60 to 0.88 for the student as the unit of analysis and 0.64 to 0.96 for the class mean as the unit of analysis.

The Netherlands Organisation for Scientific Research funded study (den Brok et.al, 2003) reported on the reliability and validity of QTI when used with secondary science students from six different countries: United States of America, Australia, Slovakia, Singapore and Brunei. In this study, multilevel structural equation modelling, correlation analyses and other techniques were used to determine the construct validity of the QTI. The results showed that there were slight differences in scale positions between the countries when plotting on the circle and that further research is necessary to determine whether the instrument has cross-cultural validity.

Gender Differences in Student Perceptions of Teacher Interpersonal Behaviour:

Many studies have been carried out where the differences attributed to the gender of the students have been reported (Friedler & Tamir, 1990; Husen, Fagerlind, & Lijefors, 1974; Judge & Okebukola, 1992; Lawrenz, 1987; Parker, Rennie, & Fraser, 1996). Friedler and Tamir (1990) examined differences in student achievement in

Israel and found that statistically significant differences in achievement scores favoured male students. Yet another study carried out by Young and Fraser (1990), reported that there were differences in responses to different types of multiple-choice questions depending on the sex of the students. Males performed better on questions with a diagrammatic representation of data and females performed better where there were descriptive items with a biological content. Other studies have considered student sex-related learning differences from the point of view of student emotions such as hope, fear, pride and shame in a learning environment (Ingleton, 1995) and suggested team-based learning is a preferred approach to learning. Student self confidence has been linked to student achievement in science, particularly for female students who were perceived as being disadvantaged by the dominant groups of boys in science classes (Stanly, 1996). Another report conveys the message that teachers who engaged in large-group discussions in science classrooms tended to elaborate more on the male responses than they did on the female responses of scientific concepts (Jones & Wheatley, 1990).

Perceptions of the classroom psychological environment of different sex students have been found to be more conspicuous as student age increased (Lawrenz, 1987). The results of a study of international secondary analysis patterns of science achievement confirmed this finding (Keeves & Aikenhead, 1995; Keeves & Kotte, 1995). This study reported that girls held more favourable attitudes to schooling and that the average effect size decreased with student age. The perceptions of different sex students are thought to be influenced by the actual learning environment (Lim, 1995). According to Lim (1995), male students perceived that they had greater opportunities for working at their own pace and in their own time whereas female students perceived that they were able to participate and have control over their own learning.

Significant differences have been found in the perceptions of boys and girls attending a single sex school (Moos, 1979a). In the present study co-educational schools were used in order to permit an unconfounded test of student sex differences. Students

were only asked to report on their sex as male or female but no questions were asked on their perceptions of sex differences for the variables under investigation. It was included in this study because the findings of previous research have reported that most often the male students in co-educational classes do not perceive inequities such as the sex related disparity in classroom discussions and activity (Guzzetti & Williams, 1996).

Potter and Rosser (1992) view inclusion of gender-neutral language and more female representations in illustrations in science textbooks as an important factor encouraging positive interest towards science in female students. The promotion of positive student attitude is viewed as an essential element in encouraging the increased participation of females in science and science related subjects (Henderson, Fisher, & Fraser, 1988b).

Cultural Differences in Students Perceptions of Teacher Interpersonal Behaviour:

Because of the strategic location of the state of Jammu and Kashmir (see map in Appendix A), it has been invaded innumerable times in its history, with the result that different cultural groups have joined the natives of the place. Since late 1989, due to the militant disturbance in the state, many people have chosen to migrate to Jammu city, which is a comparatively safer place to live. While analysing the survey data gathered in the research for this thesis, it was amazing to find that students who were included in the sample population came from 14 different cultural backgrounds and they spoke 14 different languages at home. The way of communication and perception of communication is influenced by the cultural background, (Giles & Franklyn-Strokes, 1989; Segall, Dasen, Berry, & Poortinga, 1990 and although considerable amount of research into cultural background factors is reported in the literature (Hosftede, 1980; Hui & Villareal, 1989; Judge & Okebukola, 1988; Lonner, 1980; Riah, Fraser, & Rickards, 1997; Waldrip & Taylor, 1995), not much is available on teacher-student interpersonal behaviour as measured by the QTI and nothing is available in the Indian context.

Levy, Wubbels, Brekelmans, and Morganfield (1997), investigated a sample of 550 high school students in 38 classes comprising of 117 Latinos, 111 Asians and 322 American students. The primary focus of this study was the language and cultural factors in students' perceptions of teacher communication style. This study focused on identifying ways in which the student culture relates to student perceptions of their teachers. It supported the view that students' cultural background is indeed significantly related to the perceptions that they have of their teachers' interaction behaviour. The study also reported that teachers did not seem to be aware of the cultural differences in their interactions with students in their classes in the same way as their students were, despite altering their behaviour in classes with different cultural compositions.

Fisher, Fraser, and Rickards (1997) while investigating cultural factors, found that there are associations between student cultural background and teacher-student interpersonal behaviour. This study enhances our understanding of the differences in students' perceptions of the classroom-learning environment that are attributed to differing student cultural backgrounds.

In addition to the QTI (used to assess student teacher interaction) and the WIHIC (used to assess students' perceptions of the classroom learning environment), the present study also assessed students' attitudes towards their interaction with science teachers and science classrooms. In the next section, issues associated with defining and evaluating student attitudes are discussed.

2.6 STUDENT ATTITUDES

The assessment of students' attitudes towards their science classes is regarded as an important goal in the present study. Literature related to students' attitudes is

discussed in sections on definition on student attitudes (2.6.1) and evaluation of student attitudes (2.6.2).

2.6.1 Definition of Student Attitudes

The terms associated with the domain of students' affective outcomes, such as interests or attitudes, often have been used loosely and without clarification in past studies (Peterson & Carlson, 1979). Krathwohl, Bloom, and Masia (1964) developed a taxonomy in which various affective behaviours were placed along a hierarchical continuum, which clarified some of the terms previously used to describe affective behaviours. Five major levels of internalisation were identified in the structure of the affective domain taxonomy: receiving or attending; responding; valuing; organisation; and characterisation by value and value complex. Klopfer (1971, 1976) went further and developed a structure for the affective domain specially related to science education. He included four categories in his structure: events in the natural world (refers to a question of awareness and an emotive response to experiences that requires no formal study); activities (focuses on students participation in activities related to science, both formal and informal); science (refers to the nature of science as a means of knowing about the world); and inquiry (refers to scientific inquiry processes).

According to Gardner (1975), two main categories related to the attitudes concerned with science education are attitudes towards science, and scientific attitudes. The present study has assessed students' attitudes towards science. Attitudes towards science, has been defined as “a learned disposition to evaluate in certain ways objects, people, actions, situations or propositions involved in learning science” (Gardner, 1975 p. 2).

This learned disposition refers to the way students regard science, such as interesting, boring, dull or exciting. Positive student attitudes are then measured by the degree of

motivation and interest reported by the students. Klopfer's (1976) second category, relating to students attitudes towards their science activities was a focus of the present study.

2.6.2 Evaluation of Student Attitudes

Interviews, observations and an existing attitude scales with closed items (Likert scales) have been used to measure the students' attitudes towards science. Although a number of instruments have been designed to elicit the attitudes of students towards science (Fisher, 1973; Fraser, 1978, 1981; Mackay, 1971; Wubbels, Creton, & Hooymayers, 1985), at the same time these instruments have been criticised on conceptual and empirical grounds (Gardner, 1975; Munby, 1980; Schibeci, 1984) and because of their inability to be used in different countries (Schibeci, 1986).

A review of literature revealed a large pool of science-related attitude scales. Of particular interest to this study is the *Test of Science Related Attitudes* (TOSRA) developed by Fraser (1978) to measure students, attitudes towards their science classes. Fraser based the subscales of this instrument on Klopfer's (1976) taxonomy of the affective domain related to science education. A shorter scale based on the TOSRA has been used in few Asian studies with a high degree of reliability (Goh, 1994; Goh & Fraser, 1995). This scale derived from the TOSRA was used in this present study to measure students' attitudes towards their teachers and classes in Jammu, India.

2.7 CHAPTER SUMMARY

Studies in the field of learning environment have made important contributions to the field of education by informing proposals for educational reform and enhancing researchers' and policy makers' ability to develop innovative and informed educational programmes. This chapter has discussed the historical development of

learning environment questionnaires, in particular, the QTI and the WIHIC. Several studies in which these two instruments have been used to investigate teacher-student interpersonal behaviour and students' perceptions of classroom learning environment have been reported. This study builds on these previous studies, that were carried out in different countries and contributes vital information on important contemporary aspects of education in science classrooms and has practical application for teachers and policy makers of today in India. The inclusion of student sex and cultural background has given a more diverse look into the science classrooms in Jammu, which have become more multi-cultural in the past decade due to the migration of minorities from the neighbouring districts. The combining of responses for the QTI and the WIHIC with students' attitudes to their science subjects and a measure of cognitive outcomes makes this study more distinctive. This is a unique study as for the first time any learning environment research has been carried out in Jammu, India.

The following chapter describes the research methods used in the present study. The instruments used to collect survey data are outlined along with the statistical procedures used to analyse them. A description of the interpretative procedures employed in the present study as well as the researcher's use of the analogy of researcher as *bricoleur* (Denzin & Lincoln, 1994) has also been given to make sense of the gathered information.

CHAPTER THREE

RESEARCH METHODS

*Two things fill the mind with ever new and increasing admiration and awe,
The oftener and more steadily we reflect on them:
The starry heavens above and the moral law within.*
Immanuel Kant

3.1 INTRODUCTION

The previous two chapters provided the conceptual and theoretical basis on which the studies in learning environment research have been carried out. The historical development and past uses of learning environment instruments in the past few decades were discussed. The development of the model for interpersonal behaviour, the evolution of the QTI, and a review of the studies where the QTI has been used also were presented. Additionally, students' perception of their classroom learning environments leading to the recent development of the WIHIC and its extensive use in studies was also presented. It was noted that despite all the research using the QTI and the WIHIC, none has occurred in India. This chapter deals with the research methods used in this study to change this situation.

This study started from an objectivist paradigm, in which the main focus of data collection was to administer the two learning environment instruments namely the QTI and the WIHIC along with an attitude scale. These data were further validated by conducting in-depth interviews with students and observing the classrooms where the study was being carried out. Field notes and narrative stories were also used. The combining of qualitative and quantitative methods was done to enrich and enhance the data collected (Fraser, 1992; Fraser & Fisher, 1994; Fraser & Tobin, 1991). Also in the view of Denzin and Lincoln (1994) a multiple methodologies research

approach was used as a bricolage. The researcher as bricoleur, had the task of, piecing together the information collected from a variety of sources to provide a more complete picture. With the analogy of researcher as bricoleur, the solution, or the end product, is an 'emergent construction' that is changed and reshaped with each new piece of information or method that is used.

The idea of 'grain sizes' (the use of different-sized samples for different research questions varying in extensiveness and intensiveness) in learning environment research has been used effectively in studies that combine different methodologies (Fraser & Tobin, 1991; Tobin & Fraser, 1998), and was used to help guide the collection of data for this study. The research methods were selected with an appreciation of the interplay between hermeneutic and phenomenological understanding (Taylor & Dawson, 1998). Throughout the study, I moved between hermeneutic (Taylor & Dawson, 1998) and phenomenological understanding (Roth & Bowen). Hermeneutic understanding is described by Taylor and Dawson (1998) as, insights into the perspectives on meaning of others. In this study, hermeneutic understanding was generated through the literature from the past studies, observations and interviews with the students. Phenomenological understanding, which is described as a means of gaining insights into our own conscious experiences (Taylor & Dawson, 1998), was generated for the present study through stories and impressionistic tales. The stories and subsequent commentaries led to the examination of the culture in India leading to a critical awareness of my beliefs and values.

3.2 PREPARATION FOR THE STUDY

Following the initial motivation, described in the introduction to this thesis, an examination of relevant research literature was carried out. It revealed that none of these leaning environment instruments were ever used in India. Studies had been carried out in other parts of the world but were only sub-sets of the variables examined in this study.

3.3 GATHERING THE DATA

Gathering of data for this study was not as easy a task as anticipated. The main problems faced were due to the political instability in the city of Jammu, where the data were collected. Further problems resulted from the red-tape approach of the beaurocracy. Although most of the students involved were very cooperative (students being the only subjects in this study), I still had to prolong my stay in Jammu for the purpose of data collection. The political instability of the place over a period of time has become the culture of the place. I have tried to give a feel of the new forced culture of Jammu by way of the following story.

3.3.1 First Encounter

I along with my family reached Jammu City on 6th February, 2001 at about 7.00am in the morning. We had taken a train from New Delhi to Jammu. This city is the winter capital of the state of Jammu and Kashmir and is at the extreme north of India. On our arrival, to my dismay the city was under curfew, because a few members of the minority community (Sikhs) had been killed by the militants. The usually crowded railway station had a deserted look. My father-in-law along with his chauffeur had come to receive us. This was very unusual as normally many of our friends and relatives would have been there. On getting out of the train, instead of a normal warm greeting, we were asked to rush towards the vehicle which was parked outside the arrival lounge instead of being in the parking area. This was early morning and chances of getting caught by the miscreants were less. However, we had to be home before miscreants came out on the roads, when even we could be the targets. On our way from railway station to home, the chauffeur chose some internal roads and some narrow streets instead of the main roads, to avoid being caught on the main roads. My children were horrified. It was a very unusual scene for them and us too after living in a peaceful place like Australia. The first question my 10-year-old daughter asked startled me, 'How can children attend their school in this environment?'

This was the beginning and we were house arrested for the next few days. The curfews remained in place for the next two days, and on third day traffic started flowing but schools were still closed for security purposes. The next two days, the 10th and 11th, were the weekend and again no school. At the beginning of the next week, a call was made by the opposition political party to close down all the enterprises in the city. Therefore, all the schools were closed again. I was supposed to start my data collection on this day and planned to visit schools and familiarise myself with the new environment. Apparently, my time would be lost in vain though no fault of my own.

Although in Australia, we would read in the news about the disturbing conditions occurring in that part of the world, we could never imagine what it could be like. People had learned to live in these unacceptable conditions. To my surprise, no one was complaining but instead was going with the flow at the time. There I learnt how these people had chosen to live even in these adverse conditions. On the contrary, the students, parents and teachers were trying to make the optimum use of every moment they would get. Normal school for children was rare.

This was a new experience for me and these conditions affected my data collection immensely. But at the same time, it gave me an insight into culture of the place.

3.4 SURVEY DATA COLLECTION

A large-scale quantitative probe, using the Questionnaire on Teacher Interaction (QTI), the What is Happening in this Class? (WIHIC) questionnaire and an attitude scale, was used to provide a view of students' perceptions of their classroom learning environments and student teacher interaction in these science classrooms. The attitude scale provided a parsimonious view of the students' attitudes towards science lessons and teacher interactions.

3.4.1 The Instruments Used for Data Collection

The QTI was used to measure students' perception of teacher interaction, the WIHIC was used to measure students' perceptions of their classroom environment, and an existing attitude scale was used to assess students' attitudes towards their science classes. All three instruments were given to students in the form of one questionnaire. The uniformity of the questionnaire was maintained to facilitate administration. As a result for all the instruments a five point frequency response scale was used, consisting of Almost Always, Often, Sometimes, Seldom and Almost Never, to elicit an accurate indication of how often a student perceived a particular practice as taking place. The questionnaires were worded in the Personal form to elicit the individual's perceptions of their role within the learning environment and to help me to obtain more accurate perceptions of gender and sex subgroups within the class.

There were a few questions used to obtain students' names, teachers' name, class, etc. The sex of the student was requested in order to determine if there were any differences in the perceptions of different genders in the same classroom. A variable of language spoken at home was used to determine the students' different cultural backgrounds. The students' scores in a common test were taken from the school office to enable an investigation of the associations between the students' perceptions and attitudes with cognitive outcomes. The final questionnaire that was used can be viewed in Appendix C.

Questionnaire on Teacher Interaction (QTI)

The original version of the QTI in the Dutch language consisted of 77 items and it was designed to measure secondary students' and teachers' perceptions of teacher-student interactions. After extensive analysis, the 77-item Dutch version was reduced to a 64-item version. This version was translated and administered in the USA (Wubbles & Levy, 1991; 1993). Later an Australian version of the QTI containing 48 items was developed (Fisher, Henderson, & Fraser, 1995). This study used this unaltered 48-item version of the QTI. Data collected were analysed to investigate the

reliability and validity of this instrument when used with an Indian sample and then associations between the QTI scales and other variables. The QTI may be viewed in Appendix C.

What is Happening in this Class? (WIHIC) Questionnaire

Based on previous studies, Fraser, Fisher and McRobbie (1996) developed this new learning environment instrument. The WIHIC consisting of seven scales and 56 items (Fraser, Fisher, & McRobbie, 1996) The seven scales are Student Cohesiveness, Teacher Support, Involvement, Investigation, Task Orientation, Cooperation and Equity. Data collected were analysed to investigate the reliability and validity of this instrument when used with an Indian sample. The WIHIC is presented in Appendix C.

Attitude Scale

To measure students' attitudes towards their science classroom, an already existing attitude scale was used. The scale comprises eight items measuring the extent to which students enjoy, are interested in and look forward to science lessons. Attitude Scale can be viewed in Appendix C.

3.4.2 Pre-testing of the Questionnaires

A trial of the student questionnaire took place in Australia with 30 recently-migrated students from India in the age group of 15 to 17 years. These students were asked to complete the questionnaire and later ten students were interviewed. This was done to assure the researcher that the items were readable and comprehensible. Also, the interviews were used to check whether students had responded to questionnaire items on the basis intended.

3.4.3 Survey Data Collection for the Main Study

After conducting the pilot study minor modifications were to be made for clarity in the language, and the questionnaires were sent for printing. The three instruments in the

form of one survey were administered towards the end of the academic school year. This was done so that, firstly, students would have enough time to get to know their teachers and classmates and secondly, teachers would have enough time to establish the learning environment. The researcher personally, in the presence of the science teacher, administered the questionnaire and, to ensure confidentiality, the set of questionnaires from each class was sealed in an envelope in the classroom in the presence of the teacher concerned and the students. The complete questionnaire used is presented in Appendix C.

The questionnaire was administered to, 1,021 students in years nine and ten from seven different co-educational schools. The schools were randomly selected from the metropolitan area of Jammu city, which is the winter capital of the state of Jammu and Kashmir. Care was taken to select only co-educational schools so that the gender differences could be investigated. The researcher did not face many problems in gathering the data except in a few cases where the authorities in the schools were not at all open to any sort of study to be carried out in their institution. Nearly three months before my departure for India, letters were sent to the principals of the schools, inviting them to be a part of this study together with a self-addressed reply paid envelope. Copy of the letter sent to principles can be seen in Appendix D. A consent form was also mailed out to get the permission from the parents/guardians for the schools, for their wards to be a part of this study. The inclusion of this letter was designed to comply with the ethics in research policy of Curtin University of Technology as outlined in the Handbook of Guidelines and Regulations for Higher Degrees by Research (1995). Schools were also informed that they would receive feedback regarding the class and a certificate of participation. The certificate of participation given to the schools can be seen in Appendix F.

3.5 QUANTITATIVE DATA ANALYSIS

Statistical analyses on the data collected for the quantitative aspect of the main study were used to determine the reliability and validity of the QTI and the WIHIC

questionnaire. Analysis of the data involved a number of stages to provide: reliability and validity of all the scales on the questionnaire, namely the QTI and the WIHIC, and differences and similarities between students' perceptions and attitudes from different sexes, cultural backgrounds, and effects on their cognitive achievements.

Keeping the large sample in mind, consistent and accurate methods of data entry and error checking had to be put into place. A standardised series of codes for students' names, teachers' names, school name, language spoken at home, religion, grade and gender of the student had to be used to ensure consistency in future coding. Recording a numeric value for each variable of the questionnaire did this. The questions of the QTI, the WIHIC and the Attitude scale were also coded.

Questionnaire response data were entered into a Microsoft Excel spreadsheet, which was the data format for all archived data. During data entry a random sample of student questionnaire data was manually checked while entering into the spreadsheet. Each student was allocated a numeric code. Data for the questionnaire were entered directly off the questionnaire. In cases where there were a number of missing scores in any one of the scales of the QTI or the WIHIC the questionnaire was removed from the sample.

The cognitive achievement was taken on the basis of students' comprehensive achievement through a series of tests. The scores of these test results were provided by the school office. These test scores were converted to percentages to make them uniform throughout the whole sample.

Class means, standard deviation, maximum and minimum scores were calculated for each scale of the QTI, the WIHIC and the Attitude scale using the spreadsheet program. Simple and multiple correlation analysis were used to estimate the strength of the outcome environment association for the QTI and the WIHIC. According to Sirotnik (1980) advances in research methodology in the last decade or so now make it readily possible to employ the individual students' perceptions on a questionnaire

as the unit of analysis and still fully acknowledge the 'nested' nature of the students perceptions by using class means analysis as well.

Student sex and cultural differences in teacher-student interactions and classroom learning environments were examined using a two way MANOVA with the eight scales of the QTI and seven scales of the WIHIC as dependant variable. Statistics for the QTI and the WIHIC scale reliability, discriminant validity and ability to differentiate between classrooms were completed using the class means as the unit of analysis. The methods for this aspect of the research drew on previous classroom environment studies of sex differences (Fisher, Fraser, & Rickards, 1997; Lawrenz, 1987; Young & Fraser, 1994) and cultural differences (Hofstede, 1980; Jegede & Okebukola, 1992; Levy, Wubbels, & Morganfield, 1994; Rickards & Fisher, 1999; Waldrup & Fisher, 1996b) in student perceptions.

3.6 CLASSROOM OBSERVATIONS

During times when the teachers were carrying out their normal scheduled teaching their classrooms were observed. These observations were made to gain a feel for the teacher student interactions and learning environment actually occurring in India. I observed the classrooms as a 'peripheral-member-researcher', and tried to gain an insider's perspective without being involved in activities (Adler & Adler, 1987). These classroom observations are discussed under selection of settings in section 3.6.1, recording the observations in section 3.6.2; and representing the observations in section 3.6.3.

3.6.1 Selection of the Settings

The selection of settings in which the observations were to take place was considered very important. A representative sample was selected, based on the sample of students who completed the survey questionnaire.

A total of ten classes were observed for a period of three lessons each and each lesson lasted for 40 minutes. At least one class from each of the schools in the sample was observed. However, in the three schools having the highest number of students, two classes were included to give a true proportional representation in the sample. These observations were carried out on two consecutive days to maintain a rapport with the students. Most of the time the teachers were using English as a medium of instruction but at times they did use Hindustani the most locally-used language. I was fully familiar with the second language. Initially, it was planned to video tape each lesson in progress, so that I could delve into further aspects which I could have missed. However, keeping in view the constant interruption to the electric supply, I was advised to audiotape instead.

3.6.2 Recording the Observations

The observations were recorded in the form of field notes and audio-tapes, and included explicit references to the students' interactions, ritual interpretations and social organisation (Denzin, 1989). The same field notes were discussed with the teachers who had been observed, and a few other teachers in the schools where the observations were carried out, including the principal of the school. These discussions helped me to develop an understanding of the events that had taken place while I was observing the classrooms and also allowed me to cross-check my findings. The observation technique of data collection is often criticised for its limited validity as the researcher relies on his/her own beliefs thus making results more susceptible to bias (Adler & Adler, 1994). In this study, it was attempted to minimise this possible limitation by cross-checking the understanding of the observations with the teacher concerned, other teachers and the principals in the same school. Finally, the data were represented using verisimilitude, a style of writing that "draws the reader so closely to the subject that they can be palpably felt" (Adler & Adler, 1994, p. 377). In this way, the narrative stories represent my own experiences along with other information gathered from interviews and factual documents.

Listening to the audiotapes also proved to be fruitful, as it did provide certain information at times which had been missed during the recording of the observations.

3.6.3 Representing the Observations

The type of teacher-student interaction and science classroom learning environment was produced in the form of impressionistic tales representing the fieldwork experiences. According to van Maanen (1988), impressionistic tales portray the complicated interplay of reason and emotions that creates the ambience of a social setting, such as the science classrooms. Taylor (1997a, 1997b), also supports the same idea by saying that the literary genre of the impressionistic tales makes sense of the researcher's observations and enables the reader to generate an understanding that is similar to the researcher's understanding.

According to van Maanen (1988), the researcher, the student and the teacher can be examined together in an impressionistic tale in a representational form illuminating the culture and the field worker's way of knowing and both being examined together. The impressionistic stories written in this study based on the findings of a number of observations. The tales were written from my perspective, in a descriptive form generalising the classroom situation. These tales were used to portray an archetype that could be considered representative of the typical science class in Jammu, India.

Several methods drawn from narrative inquiry were used to represent and interpret the science classroom. A selected plot was described fully, describing the settings and the characters involved (Polkinghorne, 1995). The major concern was the representation of interviews and caution needed to be taken so that their voices were treated respectfully. To minimise the chances of bad reflections, a few sections needed editing. While writing, once again I tried to place myself in relation to the observation whilst remaining reflexive. Finally, an attempt was made to use narrative forms that would engage readers aesthetically as well as critically (Brunner, 1994).

3.7 INTERVIEWS

Semi-structured interviews occurred in a fairly formal situation with most of the participants. The interviews were tape recorded and later transcribed for the analysis. These interviews included a basic list of questions that allowed scope for additional questions for the interviewee in order to follow a line of interest. The informal interviews were in the form of discussions held with the students and teachers about the learning environment and were mostly held after the observation sessions. These interviews were used as a means of understanding the complex behaviour and roles of the students and teachers (Fontana & Frey, 1994). An attempt was made to gather 'tactic knowledge' that would help me to 'immerse' myself in the culture being studied (Malinowski, 1989).

When conducting interviews it became evident that a few of the students felt uncomfortable corresponding in English. However, this did not prove to be a barrier as these students were encouraged to speak in Hindi, with which they, as well as myself, were well conversant.

The interpretation of the interviews employed a reflexive approach, which acknowledges that understandings are shaped by personal, cultural and paradigmatic conventions. This means that as a researcher I was not necessarily neutral or unbiased. There were certain contradicting views in the interviews and I had to try to ensure that they were not overlooked during the interpretation.

3.7.1 Student Interviews

The main participants in the formal interviews were the students, two of whom from each class involved in the study were interviewed. In most of the cases, students were selected at random by myself. However, in certain cases the teacher was asked to

select a representative sample covering the lower and upper range of abilities. Intensive formal semi-structured interviews were held with 64 students from 32 science classrooms involved in the study.

A semi-structured interview schedule (see Appendix E) was kept as a guideline while conducting the interviews. In the beginning, the questions were mainly drawn from the QTI, the WIHIC and the Attitude scale for the purpose of finding evidence to support the reliability and validity of the instruments. It was assumed that, by interviewing these students and observing them intensely, the learning environment in India could be better understood. Students were asked to explain their responses and, where possible, provide examples of when the practice occurred. The most emergent factors, which evolved during the course of interviewing, was that the social and cultural factors were influencing the learning environment in Jammu, India. As a result, it was felt students would like to talk more about the disturbing political conditions of the place and how this might affect their learning environment. This assisted me to gain ‘tactic knowledge’ and therefore, a better understanding of the social culture of the students.

3.7.2 Teacher Interviews

Although teacher interviews originally were not a part of the research plan, it was considered worthwhile as the study progressed. These interviews were conducted in very informal settings in the staff room of the school in the lunch break. The teachers observed were the primary focus of the interviews but in the course of time a few other science teachers would also join in and give their views. These interviews were conducted in the form of general discussions (chit-chat) to gain a more in-depth understanding of the learning environment there. In four schools, the principal of the school also joined in and gave me further clarification and understanding.

3.8 RESEARCHER'S STORIES

Connelly and Clandinin (1990) refer to the term narrative in research as a particular type of discourse, the story. Narratives take hermenutics one-step further by arguing that people understand and explain their lives through stories which feature plots, characters, times and places.

Personal experiences of the observations were captured and translated into stories. Narratives of experience involve a 'reflexive relationship between living the life story, telling a life story, telling a life story, and reliving a life story (Clandinin & Connelly, 1994). In this context, my narratives of experiences were ongoing as I retold and relived my observations in the form of my experiences.

3.8.1 Representation of Stories

Through out the data collection I was taking down field notes. With these field notes as guidelines I tried to relive the whole experience. Story writing was challenging in which I had to represent a way of knowing and thinking (Carter, 1993; Casey, 1995, Sykes & Bird, 1992). Through these stories cultural aspects affecting the learning environment could be determined.

Before the start of data collection I considered Clandinin and Connolly's (1994) four directions of focus, describing as inwards, outwards, backwards and forwards. '*Inwards*' refers to those contributions made towards the 'painting' of our own impressions (Taylor, 1997a, 1997b) including thoughts, feelings, reactions and relevant information. '*Outwards*' refers to the 'existential' factors, such as the environment and what is occurring. '*Backwards*' and '*forwards*' refers to those aspects relating to time (i.e. past, present and future).

Soon after each observation, I would identify the incidents or aspects of the lesson, which I would include in the story. On the same night, I would try to make an outline draft of the story to minimise the chances of distorting it. Thus, an effort was made to

re-create my experiences of the observations, and represent them in the form of stories.

3.8.2 Interpreting the Stories

Each story was followed by a commentary as a second level of representation (Geelan, 1997). The commentaries were used to help me to deconstruct the text and explore my notions of what I had observed. The constructed representation of my experiences is demonstrated in the stories written. The interpretation of these stories is presented in Chapter 7.

The interpretations, or understandings of the stories, were shaped by a combination of interpretative styles. The grounded theory ideas of Glaser and Strauss (1967) led to the identification of emergent themes. Denzin's (1989) interpretative interaction directed my focus on life experiences- epiphanies- that shaped and altered the way in which I viewed myself and finally, the constructed representation of my experiences is demonstrated in the stories presented in Chapter 7.

3.9 CHAPTER SUMMARY

This chapter has provided a description of the methodology used to complete this study and the rationale that prompted the use of both the qualitative and quantitative research methods. The objectives of the study guided the study and justified the initial selection of classroom learning environment and teacher-student interaction as the main foci of the study. The rationale for selecting the data collection instruments and a brief description of the development, validation and descriptive information for each instrument has been presented. The instruments used for survey data collection were the QTI, the WIHIC and the Attitude scale. This quantitative data was complemented with qualitative data, e.g. interviews and observations.

The questionnaire containing the QTI, the WIHIC and the Attitude scale along with questions on sex, language spoken at home, name and class of the students was

administered to 1,021, year nine and ten students in Jammu, India. Data collected were statistically analysed to explore the reliability and validity of instruments in Jammu. The criteria used to ensure the validity and reliability of instruments were: internal consistency reliability; discriminant validity; ability to differentiate between the classes; and predictive validity. The t test was computed to investigate whether there were significant differences in students of different sexes or students coming from different cultural backgrounds.

A critical constructivist perspective (Dawson & Taylor, 1998) brought the study to the forefront as it was felt that data did not always reflect what was observed in the classroom. By using the 'researcher as bricoleur method' (Denzin & Lincoln, 1994), classroom observations, interviews with students and researchers' stories were used to capture the interpretations in Jammu, India.

The next chapter presents the validation and descriptive information for the 48-item version of the QTI used in this study.

CHAPTER FOUR

VALIDATION AND DESCRIPTIVE INFORMATION FOR THE QTI AND THE WIHIC

*...it is curiosity, initiative, originality, and the ruthless application of honesty that count in research-
much more than feats of logic and memory alone.*

Julian Huxley

4.1 INTRODUCTION

In the previous chapter the preparation for the study along with the objectives were discussed. The selection of instruments and the preparation of the questionnaire containing the QTI, the WIHIC, the attitude scale and certain introductory questions were also discussed. This chapter reports on the results of the quantitative data of the study to support the validity and reliability of the QTI and the WIHIC when used with a large sample of science students in Jammu, India.

The quantitative data for the study were collected from 1,021 science students in Years 9 and 10, from 32 different classes in seven different co-educational schools in Jammu, India. The results from the Indian study, for the first time, provide validation data for the QTI and the WIHIC, which were already validated in other parts of the world. The validation data for the two instruments are presented under the following headings:

4.2 Validation for the QTI (Questionnaire on Teacher Interaction)

4.3 Validation for the WIHIC (What is Happening in This Class)

4.4 Validation for the Attitude Scale

4.2 VALIDATION OF THE QTI

The validity and reliability information for the QTI when used with the Indian sample of this study are presented in Table 4.1. To determine the degree to which items in the same scale measure the same aspect of teacher-student interpersonal behaviour, a measure of internal consistency, the Cronbach alpha reliability coefficient (Cronbach, 1951) was used. The highest alpha reliability was obtained for the scales of Understanding and Dissatisfied and the lowest for Student Responsibility/ Freedom.

Table 4.1

Scale Internal Consistency (Cronbach Alpha Reliability) and Ability to Differentiate Between Classrooms (ANOVA results) for the QTI

Scale	Alpha Reliability	ANOVA (η^2)
Leadership	0.71	0.13*
Helping/Friendly	0.65	0.14*
Understanding	0.72	0.20*
Student Responsibility/Freedom	0.50	0.13*
Uncertain	0.62	0.25*
Dissatisfied	0.72	0.18*
Admonishing	0.58	0.21*
Strict	0.53	0.16*
Students n = 1,021	* $p < 0.001$	Classes n = 31

The reliability results for the scales of QTI were consistently above 0.50. This suggests that QTI can be considered a reliable tool (De Vellis, 1991) with Indian students. However, results obtained for Student Responsibility/ Freedom should be interpreted with caution as the low alpha coefficient for this scale may be attributed to the nature of the Indian culture. The students may be reluctant to provide a frank opinion about these behaviours of their teachers.

The ability of a teacher-student interaction instrument to differentiate between classes is important. The instrument's ability to differentiate in this way was measured using one-way analysis of variance (ANOVA). The η^2 statistic was calculated to provide an estimate of the strength of the association between class membership and the dependent variables as shown in Table 4.1. The η^2 statistic for the QTI, indicates that the amount of variance in scores accounted for by class membership ranged from 0.13 to 0.25 and was statistically significant ($p < 0.001$) for all scales. It appears that the instrument is able to differentiate clearly between the perceptions of students in different classrooms.

Although the QTI has been demonstrated to be a valid and reliable instrument for use in India, still its alpha reliability coefficient and η^2 are constantly lower compared with those values from Western countries as can be seen in Tables 4.2 and 4.3. The lower scores could be attributed to the culture where students are reluctant to provide a free view or these students were exposed to this type of study for the first time in their lives and were not sure about the way to respond. Despite the fact that the alpha reliability scores are lower as compared with other countries where the QTI instrument has been tested, still we can say with confidence that the QTI is a reliable instrument for use in India as reliability scores are consistently above 0.50 (De Vellis, 1991).

Table 4.2

Comparison of the Alpha Reliability Coefficients (Internal Consistency) for the QTI Scales in Six Different Countries.

Alpha Reliability Coefficients						
Scale	USA ^a	Australia ^a	Netherlands ^a	Brunei ^b	Singapore ^c	India ^d
Leadership	0.80	0.83	0.83	0.69	0.81	0.71
Helping/Friendly	0.88	0.85	0.90	0.80	0.88	0.65
Understanding	0.88	0.82	0.90	0.64	0.82	0.72
StuResp/ Freed	0.76	0.68	0.74	0.58	0.50	0.49
Uncertain	0.79	0.78	0.79	0.58	0.66	0.62
Dissatisfied	0.83	0.78	0.86	0.77	0.87	0.72
Admonishing	0.84	0.80	0.81	0.70	0.63	0.58
Strict	0.80	0.72	0.78	0.62	0.64	0.53
Students	<i>n</i> = 1,606	<i>n</i> = 792	<i>n</i> = 1,105	<i>n</i> = 1,188	<i>n</i> = 720	<i>n</i> = 1,021
Classes	<i>n</i> = 66	<i>n</i> = 46	<i>n</i> = 66	<i>n</i> = 54	<i>n</i> = 20	<i>n</i> = 31
a Source Wubbels and Levy (1993, p. 166)			b Source Riah (1998)			
c Source Fisher and Rickards (1997, p. 137)			d Source Present study.			

Table 4.3

Comparison of the Amount of Variance Accounted for by Class Membership (η^2) for the QTI in Five Countries.

Scale	ANOVA η^2				
	USA ^a	Australia ^a	Netherlands ^a	Brunei ^b	India ^c
Leadership	0.41*	0.48**	0.59*	0.18**	0.13**
Helpful/Friendly	0.22*	0.33**	0.48*	0.27**	0.14**
Understanding	0.28*	0.29**	0.43*	0.22**	0.20**
Stu Resp/Freedom	0.29*	0.28**	0.36*	0.21**	0.13**
Uncertain	0.38*	0.38**	0.59*	0.22**	0.25**
Dissatisfied	0.19*	0.20**	0.39*	0.33**	0.18**
Admonishing	0.25*	0.25**	0.39*	0.39**	0.21**
Strict	0.43*	0.30**	0.45*	0.30**	0.16**
Students	$n = 1,606$	$n = 792$	$n=1,105$	$n = 1,188$	$n = 1,021$
Classes	$n = 66$	$n = 46$	$n=66$	$n = 54$	$n = 31$
* $p < 0.01$ ** $p < 0.001$		a Source Wubbels & Levy (1993)			
b Source Riah, (1998)		c Source Present study.			

Table 4.3 shows the proportion of variance in the scales of the QTI, which can be accounted for by class membership. The values in the Indian study are smaller than those from the studies in other countries, but they are statistically significant at $p < 0.001$ for all the scales. Further analyses were also completed to explore the inter-scale correlation in the QTI. The scales of the QTI are arranged to form a circular pattern or circumplex model and are expected to be correlated. As shown in the Table 4.4, the results of the inter-scale correlations from the study generally reflect the circumplex nature of the QTI and further confirm the validity of the instrument. The Leary model predicts that correlations between two adjacent scales are expected to be the highest, but the correlation gradually decreases as the scales move further apart until opposite scales are negatively correlated. The pattern is clearly reflected in Table 4.4 where the results of the inter-scale correlations from the study reflect the circumplex nature of the QTI. For example, the scale Leadership is correlated closely and positively with Helping/Friendly (0.58) and Understanding (0.63). This correlation decreases with other scales with the highest negative correlation of -0.28 occurring with the Admonishing scale. The results from these analyses confirm the circumplex nature of the QTI. The reliability and the ability to differentiate between classes suggest that the QTI can be used as a valid instrument in India.

Table 4.4
Inter-scale Correlation for the QTI

	Lea DC	HFr CD	Und CS	Sre SC	Unc SO	Dis OS	Adm OD	Str DO
Leadership DC		0.58	0.63	0.20	-0.18	-0.27	-0.28	0.15
Help/Friendly CD			0.61	0.35	-0.15	-0.27	-0.25	0.11
Understanding CS				0.18	-0.25	-0.33	-0.28	0.10
Stu Res/ Free SC					-0.15	-0.14	-0.25	0.11
Uncertain SO						0.52	0.60	0.20
Dissatisfied OS							0.53	0.27
Admonishing OD								0.20
Strict DO								

n = 1,021 students in 31 classes

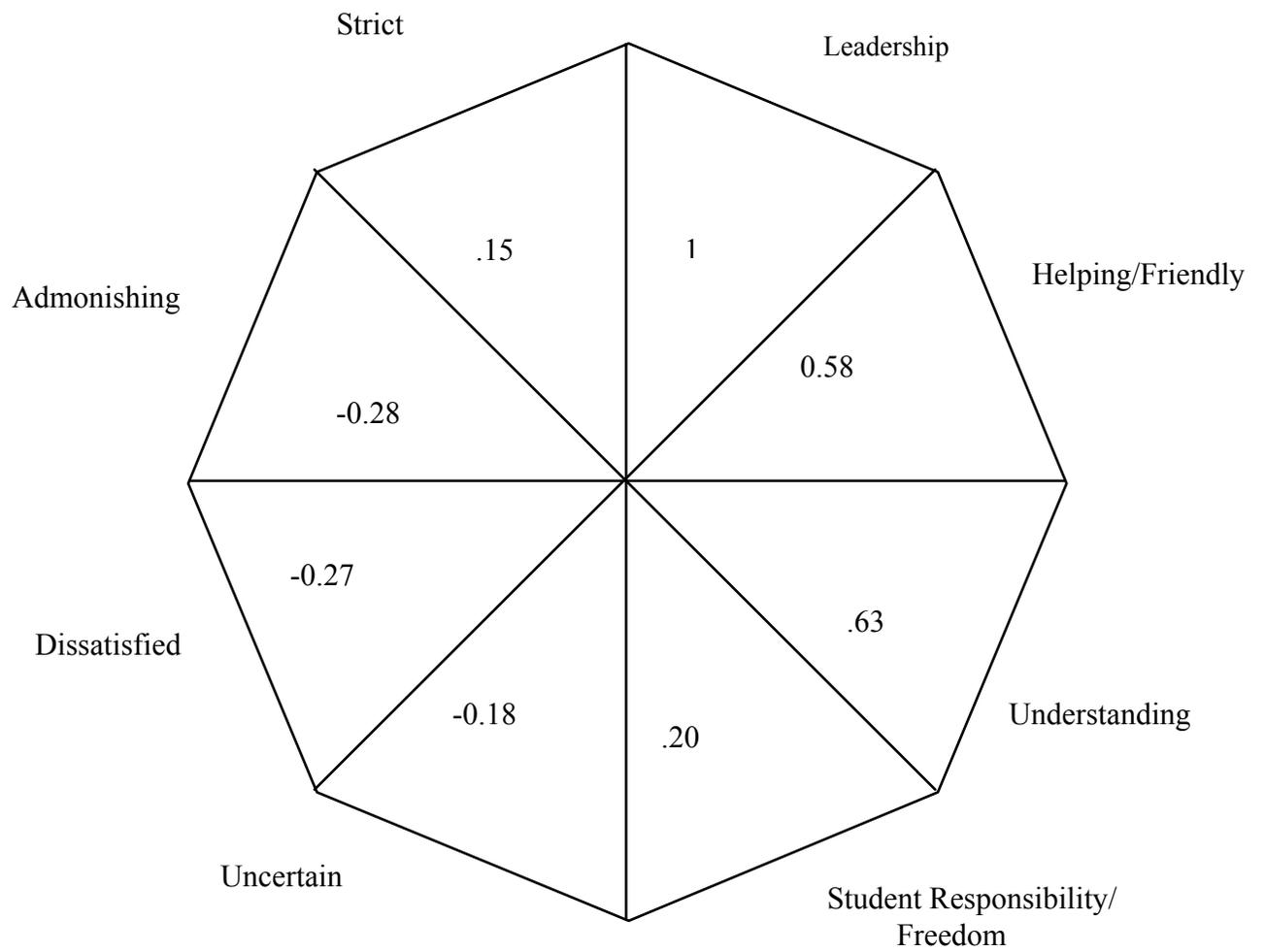


FIGURE 4.1. Correlation of Leadership scale with other QTI scales.

Table 4.5, reports on the means and standard deviations for each of the scales of the QTI and indicates that the students perceive their teachers as demonstrating leadership and understanding behaviours quite often. The teachers' helping/friendly, giving students responsibility and freedom and strict behaviours are less noticeable. The teachers seldom are uncertain, dissatisfied or admonishing. The students perceived the Leadership behaviour most favourably with a score of 3.15 and the Uncertain least with a score of 1.82. The standard deviation for all the scales ranged from 0.48 to 0.64, suggesting that there was not a large diversity in the students' perceptions

Table 4.5

Mean and Standard Deviation Scales of the QTI

Scale	Mean	Std. Dev.
Leadership	3.15	0.5
Helping/Friendly	2.28	0.53
Understanding	3.06	0.55
Student Responsibility/ Freedom	2.32	0.48
Uncertain	1.82	0.56
Dissatisfied	1.84	0.64
Admonishing	1.93	0.56
Strict	2.65	0.51

n= 1,021 Students in 31 Classes

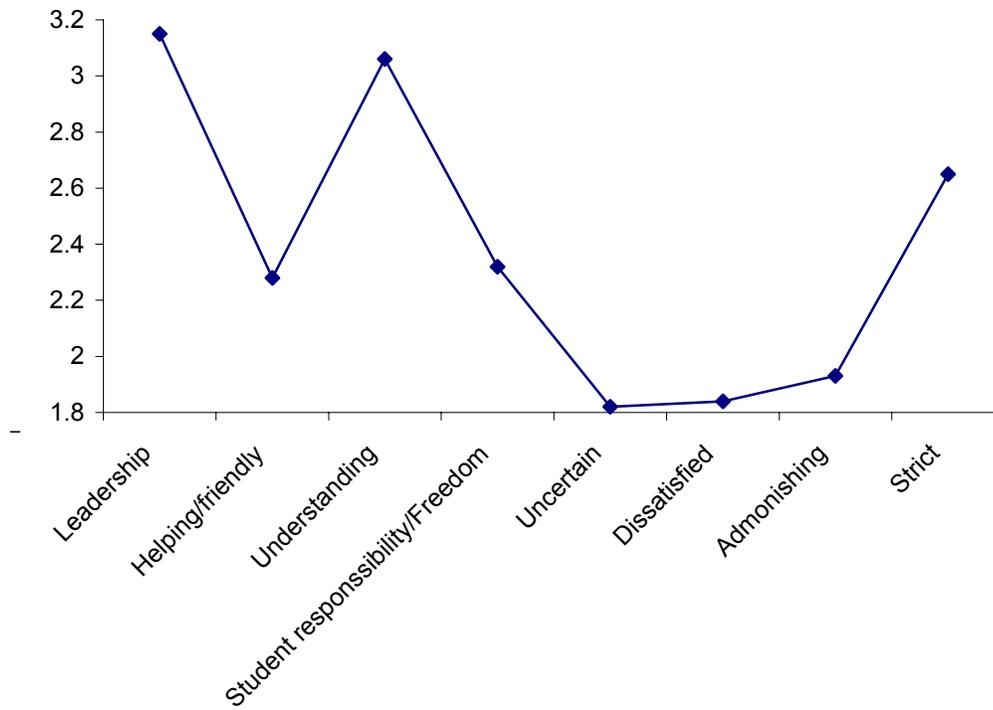


Figure 4.2. Students' perceptions of interpersonal teacher behaviour in science classes on the QTI scales.

4.3 VALIDATION OF THE WIHIC

In the statistical analyses of the WIHIC the internal consistency (Cronbach alpha reliability) and discriminant validity (mean correlation of a scale with the other six scales of the instrument) were used and these results are reported in Table 4.6. The reliability coefficients for the different WIHIC scales ranged from 0.58 to 0.83. The highest alpha reliability (0.83) was obtained for the Equity scale and the lowest (0.58) for the scale Student Cohesiveness. The mean correlations of one scale with the other scales ranged from 0.38 to 0.47. These values can be regarded as small enough to suggest that each scale of the WIHIC has adequate discriminant validity, even though

the scales assess somewhat overlapping aspects of classroom environment. In keeping with learning environment research tradition, the η^2 statistic was calculated to provide an indication of the degree to which each scale could differentiate between the perceptions of students in different classes. The η^2 values ranged from 0.09 to 0.14 and was statistically significant ($p < 0.001$) for each scale. This indicates that each scale of the WIHIC is capable of differentiating significantly between classes. Overall the reliability, discriminant validity and ANOVA results confirm that the WIHIC can be used with confidence for further research in India.

Table 4.6

Scale Internal Consistency (Cronbach Alpha Reliability), Discriminant Validity (Mean Correlation with other Scales) and Ability to Differentiate Between Classrooms (ANOVA results) for the WIHIC

Scale	Alpha Reliability Coefficients	Inter-Scale Correlation	Anova η^2
Student Cohesiveness	0.58	0.38	0.10*
Teacher Support	0.78	0.42	0.14*
Involvement	0.76	0.47	0.14*
Investigation	0.77	0.40	0.10*
Task Orientation	0.70	0.39	0.12*
Cooperation	0.77	0.42	0.09*
Equity	0.83	0.43	0.14*
Students n = 1,021 in 31 classes		* $p < 0.001$	

As reported in the Table 4.2, the alpha reliability coefficients for the QTI were consistently smaller in the Indian study when compared with the values in the studies in some other countries. A similar pattern occurs when alpha reliability coefficients of the WIHIC in India are compared with those from other countries. However, at the same time they are consistently greater than 0.50. This consistency confirms that the WIHIC can be used with confidence in India.

Table 4.7

Comparison of the Alpha Reliability Coefficients (Internal Consistency) for the scales of the WIHIC in Five Different Countries.

Scale	Alpha Reliability Coefficients				
	Australia ^a	Taiwan ^a	Brunei ^b	Singapore ^c	India ^d
Student Cohesiveness	0.81	0.86	0.88	0.90	0.58
Teacher Support	0.88	0.87	0.91	0.88	0.78
Involvement	0.84	0.85	0.87	0.88	0.76
Investigation	0.88	0.90	0.88	0.91	0.77
Task Orientation	0.88	0.86	0.81	0.90	0.70
Co-operation	0.89	0.87	0.90	0.91	0.77
Equity	0.93	0.90	0.94	0.92	0.83
Students	<i>n</i> = 1,081	<i>n</i> = 1,879	<i>n</i> = 1,18	<i>n</i> = 2,310	<i>n</i> = 1,021
Classes	<i>n</i> = 50	<i>n</i> = 50	<i>n</i> = 54	<i>n</i> = 75	<i>n</i> = 31

a Source Aldridge, Fraser & Haung (1999)

b Source Khine (2001)

c Source Chionh & Fraser (1998)

d Source Present Study

A comparison of alpha reliability coefficients for the WIHIC when used in different countries is shown in Table 4.7.

Table 4.8

Comparison of the Amount of Variance Accounted for by Class membership (η^2) for the WIHIC in Four Countries.

Scale	ANOVA η^2			
	Australia ^a	Taiwan ^a	Brunei ^b	India ^c
Student Cohesiveness	0.11**	0.07**	0.08**	0.10***
Teacher Support	0.14**	0.34**	0.13**	0.14***
Involvement	0.09*	0.11**	0.10**	0.14***
Investigation	0.15**	0.22**	0.80**	0.10***
Task Orientation	0.14**	0.36**	0.08**	0.12***
Cooperation	0.15**	0.28**	0.09**	0.09***
Equity	0.15**	0.24**	0.17**	0.14***
Students	$n = 1,081$	$n = 1,879$	$n = 1,188$	$n = 1,021$
Classes	$n = 50$	$n = 50$	$n = 54$	$n = 31$

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

a Source Aldridge & Fraser (1999) p. 52

b Source Khine (2001)

c Source Present study.

A comparison of the amount of variance accounted for class membership (η^2) for the WIHIC when used in different countries is shown in Table 4.8. Although amount of variance in all the countries did differ but they were all statistically significant.

Item means and standard deviations were computed to determine the nature of science learning environment using the WIHIC. The very high mean scores shown in Table 4.9 suggest a very positive classroom environment, with the mean scores ranging between 3.89 and 4.84. The students perceived Task Orientation, Student Cohesiveness and Cooperation most positively. The scores for these three scales are 4.84 for Task Orientation, 4.77 for Student Cohesiveness and 4.49 for Cooperation. The standard deviation for all the scales is less than 1, suggesting that there was not large diversity in the students' perceptions. Generally, the students perceive a very positive science classroom learning environment.

Table 4.9
Means and Standard Deviations for WIHIC Scales

WIHIC Scales	Mean	Standard Deviation
Student Cohesiveness	4.77	0.54
Teacher Support	4.00	0.87
Involvement	3.89	0.79
Investigation	3.89	0.83
Task Orientation	4.84	0.63
Cooperation	4.49	0.77
Equity	4.57	0.89
Students n=1,021		

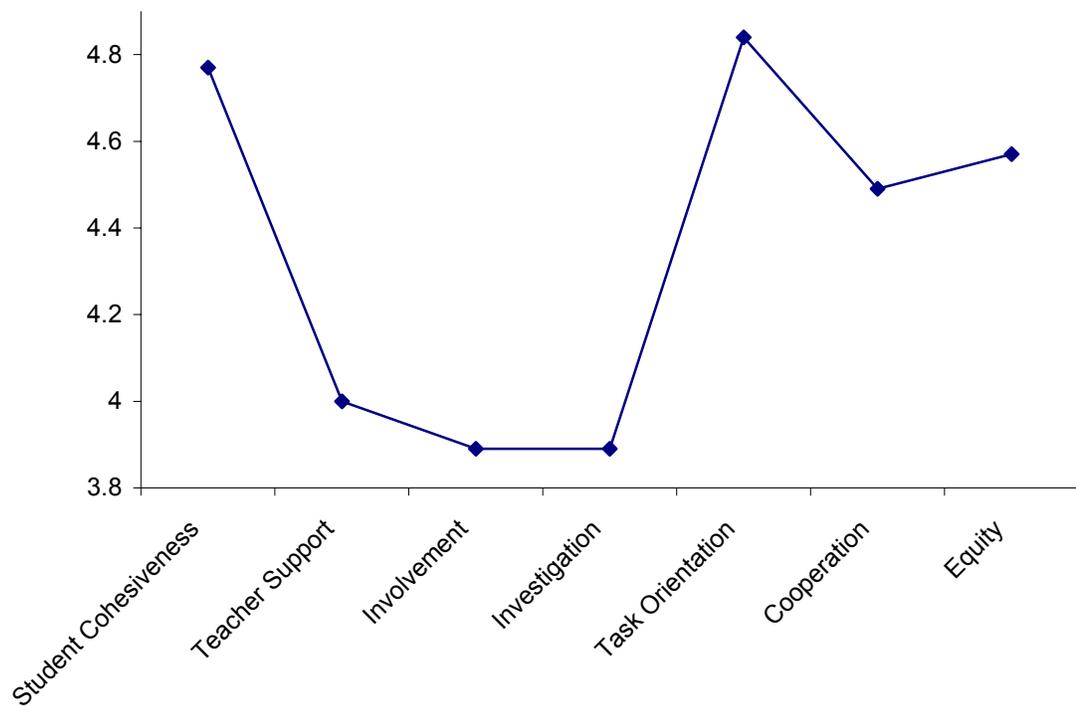


Figure 4.3. Students' perceptions of science classes using WIHIC scales.

4.4 VALIDATION OF THE ATTITUDE SCALE

It was found that scale internal consistency (Cronbach alpha) for the Attitude towards Science was 0.77, indicating that the scale has satisfactory reliability. The mean for the attitude scale when responded on a five point likert type scale is 4.15. This high mean score confirms the very positive attitude of students towards science classes and teachers in India. The results for the attitude scale can be seen in Table 4.10

Table 4.10

Mean, Standard Deviation and Scale Internal Consistency (Cronbach Alpha Reliability) for the Attitude Scale.

Scale	No of Items	Mean#	Std. Deviation	Alpha Reliability
Attitude to Science	8	4.15	0.68	0.77
# Range of 1 to 5	n = 1,021 students			

4.5 CHAPTER SUMMARY

This chapter has presented the descriptive statistics to support the validity and reliability of the 48-item Australian version of the QTI and the 56-item WIHIC as used in this study. Reliability and validity scores obtained for the QTI and the WIHIC confirm that these two instruments can be used with confidence in India.

The alpha reliability and ability to differentiate between classrooms ANOVA (η^2) for the QTI and the WIHIC studies in other countries has also been given for comparison with the Indian data. The validation data of the Attitude scale confirms its reliability and validity for use in India. The next chapter examines the quantitative results related to other variables in response to the objectives of the present study.

CHAPTER FIVE

ANALYSIS AND RESULTS FROM THE QUANTITATIVE DATA

Ideas improve. The meaning of words participates in the improvement. Plagiarism is necessary. Progress implies it. It embraces an author's phrase, makes use of his expressions, erases a false idea, and replaces it with the right idea.

Guy Dubord

5.1 INTRODUCTION

This chapter is devoted to describing the analysis and results of the large-scale quantitative survey that was used as the main data collection process for the study. Survey data were intended to be used for exploring student-teacher interactions and science classroom learning environments in India. Data were collected using the QTI and the WIHIC questionnaire to measure students perceptions of their interaction with their science teacher, perceptions of their science classroom learning environment, along with their attitudes towards their high school science teacher and science class. Gender differences, cultural differences assessed on the basis of language spoken at home, religious differences in interpersonal behaviour and perception of classroom were also assessed. The results of the study were analysed and are presented in the following sections under these headings:

5.2 Attitudes

5.3. Gender Differences

5.4. Cultural Differences

5.5. Religious Differences

5.6 Cognitive Achievement.

5.2 ATTITUDES

5.2.1 Associations between Teacher-Student Interactions and Attitude towards Science Class

One of the aims of the study was to investigate whether the nature of teacher-student interactions affects students' attitudes towards science classes. Associations between the perceptions of teacher-student interactions and students' attitudes were explored using simple and multiple correlation analyses. The results of the analyses are shown in Table 5.1. For the scales Leadership, Helping/Friendly, Understanding and Student Responsibility/Freedom the associations are positive and statistically significant, where as for the Uncertain, Dissatisfied and Admonishing scales the associations are negative and statistically significant.

The multiple correlation (R) between the set of QTI scales and attitude to science class was 0.39. The R^2 value which indicates the proportion of variance in attitude to science class that can be attributed to students' perceptions of teacher-student interactions was 15%. To determine which of the QTI scales contributed most to this association, the standardized regression coefficient (β) was examined for each scale. It was found that only the scales of Leadership and Helping/Friendly retained their significance and were positively and significantly associated with attitude to science classes.

Table 5.1

Associations between QTI Scales and Attitude to Science Class in terms of Simple Correlations (R), Multiple Correlations and Standardized Regression Coefficient (β)

Scale	Attitude to Science Class	
	r	β
Leadership	0.31**	0.15*
Helping/Friendly	0.31**	0.16*
Understanding	0.28**	0.02
Student Responsibility/Freedom	0.07*	0.02
Uncertain	-0.21**	-0.07
Dissatisfied	-0.24**	-0.07
Admonishing	-0.25**	-0.09
Strict	-0.00	0.00
Multiple Correlations	R = 0.39** R ² = 0.15	
* $p < 0.05$, ** $p < 0.001$		n=1,021

5.2.2 Associations between Classroom Environment and Attitudes towards Science Class

Associations between science classroom environments as measured by the WIHIC scales and students' attitude towards science class was explored by simple and multiple correlation analyses. As shown in Table 5.2, the results of the simple correlation analysis revealed that all seven scales were significantly correlated with attitude to science class ($p < 0.01$). It was found that these associations were positive and ranged from 0.17 to 0.38.

The multiple correlation (R) was 0.43 and statistically significant ($p < 0.01$). This strongly supports the conclusion that the nature of the classroom environment is

strongly influencing students' attitudes towards science lessons. In order to further interpret this relationship, the standardised regression coefficient (β) was also examined. It was found that out of seven scales, three scales retained their significance ($p < 0.01$). This means that the scales Investigation, Task Orientation and Equity are independent predictors of individual students' attitude towards science class. The R^2 value, which indicates the proportion of variance in attitude towards science class that can be attributed to students' perception of classroom environment, was 19%.

Table 5.2

Associations between WIHIC Scales and Attitudes Towards Science Class in terms of Simple Correlations (r), Multiple Correlation (R) and Standardised Regression Coefficient (β)

Scale	Attitude to Science Class	
Student Cohesiveness	0.17*	-0.03
Teacher Support	0.23*	0.04
Involvement	0.24*	0.01
Investigation	0.27*	0.10*
Task Orientation	0.38*	0.27*
Cooperation	0.23*	0.00
Equity	0.32*	0.15*
Multiple Correlation	R = 0.43**	
	R ² = 0.19	
* $p < 0.01$	n = 1,021	

5.3 GENDER DIFFERENCES

5.3.1 Teacher-Student Interactions and Gender Differences

The associations between the students' perceptions of teacher interpersonal behaviour and the gender of the students were analysed. The gender differences in students' perceptions of classroom learning environment were examined by splitting the total number into male (440) and female (581) students involved in the study.

To examine the gender differences in students' perceptions of teacher interpersonal behaviour in science classes, the within-class gender subgroup mean was chosen as the unit of analysis which aims to eliminate the effect of class differences due to males and females being unevenly distributed in the sample. In the data analysis, male and female students' mean scores for each class were computed, and the significance of gender differences in students' perceptions of teacher interpersonal behaviour and science classroom were analysed using an independent t-test. Table 5.3 shows the scale item means, male and female differences, standard deviations, and t-values. The purpose of this analysis was to establish whether there are significant differences in perceptions of students according to their gender.

As can be seen in the Table 5.3, out of eight scales of the QTI, the gender differences in the perceptions of males and females were found to be statistically significantly different on seven scales. According to the results, female students perceived more positively the leadership displayed by their teachers and the helping friendly and understanding behaviours of their teachers. On the other hand, male students perceived that their teachers displayed more uncertain, admonishing and dissatisfied behaviours and were giving more student responsibility. The graphical representation of these results can be seen in Figure 5.1. The gender differences found in this study are similar to the results reported by Fisher & Rickards (1998) and Khine & Fisher (2001). Fisher and Rickards (1998) reported on Australian students, and found that seven scales of the QTI had significant differences in the perceptions of students of

different genders. Khine & Fisher (2001), in a study in Brunei found that six scales of the QTI had significant differences.

Table 5.3

Item Mean and Standard Deviation for Gender Differences in Students' Perceptions of Teacher-Student Interaction Measured by the QTI Scales

Scale	Gender	Item Mean	Mean Difference (M-F)	Std. Deviation	t
Leadership	Males	4.02	-0.3	0.74	6.93**
	Females	4.32		0.59	
Helping/ Friendly	Males	3.66	-0.19	0.75	4.05**
	Females	3.85		0.67	
Understanding	Males	3.85	-0.41	0.78	8.69**
	Females	4.26		0.65	
Student Responsibility	Males	3.16	0.12	0.64	2.91*
	Females	3.04		0.65	
Uncertain	Males	2.70	0.47	0.76	10.23**
	Females	2.23		0.68	
Dissatisfied	Males	2.73	0.49	0.88	9.18**
	Females	2.24		0.77	
Admonishing	Males	2.89	0.55	0.76	12.11**
	Females	2.34		0.64	
Strict	Males	3.53	-0.01	0.68	0.29
	Females	3.54		0.68	

* $p < 0.05$, ** $p < 0.001$ males ($n = 440$); females ($n = 581$)

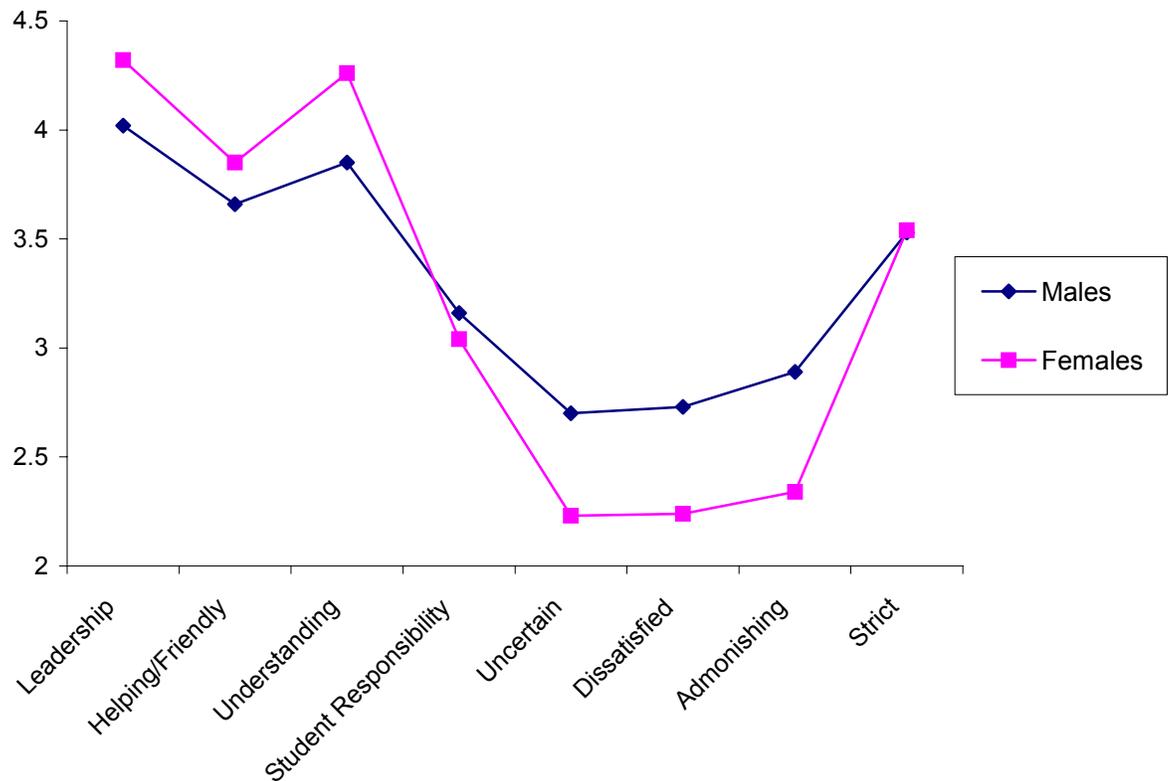


Figure 5.1. Means for gender differences in students' perception of teacher-student interactions measured by the QTI scales.

5.3.2 Perceptions of Learning Environments and Gender Differences

Gender differences with the WIHIC were also investigated in a similar manner as for the QTI. Scale item means for each gender group, mean differences, standard deviations and t-values were computed. Table 5.4 reports these values. Out of seven scales, four scales were found to have significant differences in male and female student perceptions. These scales are Student Cohesiveness, Investigation, Cooperation and Equity. Female students perceived student cohesiveness more positively, showing their regard for their fellow students and helping and getting help

whenever needed. It was also found that female students perceived task orientation more favourably than did their male counterparts. The female students perceived that it is important to complete planned activities and stay on the subject matter more than did the male students who participated in the survey.

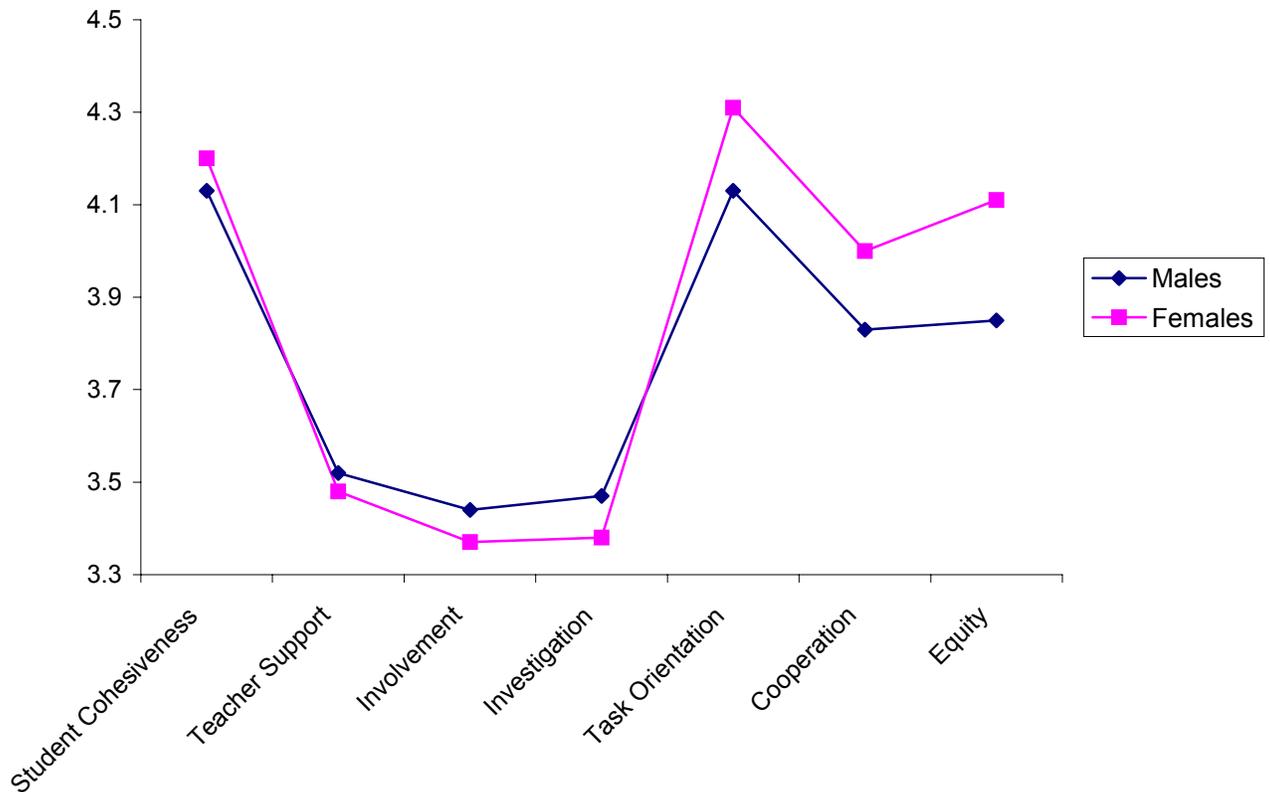


Figure 5.2. Means for gender differences in students' perceptions of learning environments measured by the WIHIC scale.

As for the Cooperation scale, female students perceived that more cooperation existed among the students equally, again female students perceived more equity in the classroom. From these analyses, it is apparent that female students perceived their learning environment more favourably than did male students, particularly in terms of Student Cohesiveness, Task Orientation, Co-operation and Equity. Similar results

were reported from the study of Khine & Fisher (2001), where females perceived the environment more favourably than did the males on three scales namely Task Orientation, Cooperation and Equity.

Table 5.4.

Item Mean and Standard Deviation for Gender Differences in Students' perceptions of learning Environment Measured by WIHIC Scales

Scale	Gender	Item Mean	Mean Difference (M-F)	Std. Deviation	t
Student Cohesiveness	Males	4.13	-0.07	0.45	2.38*
	Females	4.20		0.48	
Teacher Support	Males	3.52	0.04	0.75	0.83
	Females	3.48		0.77	
Involvement	Males	3.44	0.07	0.69	1.6
	Females	3.37		0.69	
Investigation	Males	3.47	0.09	0.66	1.98
	Females	3.38		0.77	
Task Orientation	Males	4.13	-0.16	0.59	5.00**
	Females	4.31		0.50	
Cooperation	Males	3.83	-0.17	0.69	3.92**
	Females	4.00		0.65	
Equity	Males	3.85	-0.26	0.68	5.25**
	Females	4.11		0.67	

* $p < 0.05$, ** $p < 0.01$ males ($n = 440$); females ($n = 581$)

5.4 CULTURAL DIFFERENCES

5.4.1 Associations between Teacher-Student Interaction and Cultural Group of the Student

Associations between teacher-student interactions and students, on the basis of the cultural group they come from, were examined. The cultural group of the students was determined by the question 'language spoken at home'. Jammu city is understood to be a melting pot of various cultures, because of the migration from neighbouring provinces into the city due to the various political reasons of the past five to six decades. It was amazing to know that students covered in this study, who underwent the same core curriculum at school, came from 13 different cultural subgroups. The languages spoken at home, a clear indication of their cultural backgrounds, are Hindi, Kashmiri, Dogri, Punjabi, Balti, Pahari, English, Badarwahi, Muzfarabadi, Punchy, Telgu, Urdu and Kistwari. However, only four of these groups contain sufficient numbers for the analyses. These are Hindi, Kashmiri, Dogri and Punjabi, which constituted 98% of the sample.

To examine the cultural differences in students' perception of the teacher-student interaction in the science classes, the within-class cultural subgroup mean was chosen as the unit of analysis which aims to eliminate the effect of class differences due to the strength of various groups being unevenly distributed in the sample.

In the data analysis, mean scores for each of the four cultural groups were computed. Table 5.5 shows the scale item means and F values of the scales of the QTI with the perceptions of students from the four main cultural groups. The purpose of this analysis is to establish whether there are significant differences in the perceptions of students according to their cultural backgrounds

Table 5.5

Item Mean for Cultural Differences (Language Spoken at Home) in Students' Perceptions of Teacher-Student Interactions Measured by the QTI Scales.

Scale	Language Spoken at Home				F Value
	Hindi	Kashmiri	Dogri	Punjabi	
Leadership	4.22	4.16	4.12	4.16	1.01
Helping/ Friendly	3.78	3.86	3.64	3.71	3.48**
Understanding	4.14	4.12	3.86	4.08	6.82**
Student Responsibility	3.07	3.12	3.10	3.12	0.33
Uncertain	2.41	2.34	2.64	2.36	6.11**
Dissatisfied	2.46	2.26	2.61	2.51	5.93**
Admonishing	2.59	2.45	2.71	2.60	3.94**
Strict	3.60	3.41	3.50	3.50	4.27**
	<i>n</i> = 522	<i>n</i> = 221	<i>n</i> = 175	<i>n</i> = 82	

** $p < 0.001$

.As can be seen in Table 5.5, the differences in the perceptions of students about their science teachers on six of the eight QTI scales are statistically significant. The scales in which there were significant differences were Helping/Friendly, Understanding, Uncertain, Dissatisfied, Admonishing and Strict. Tukey's post hoc test ($p < 0.05$) revealed that for the Helping/Friendly scale the Kashmiri group of students was

dominant and had statistically significant higher means while the Dogri group of students had the lowest mean for the scales of Understanding and higher means for the scales of Admonishing, Dissatisfied and Strict. Graphical representation of these results can be seen in Figure 5.3.

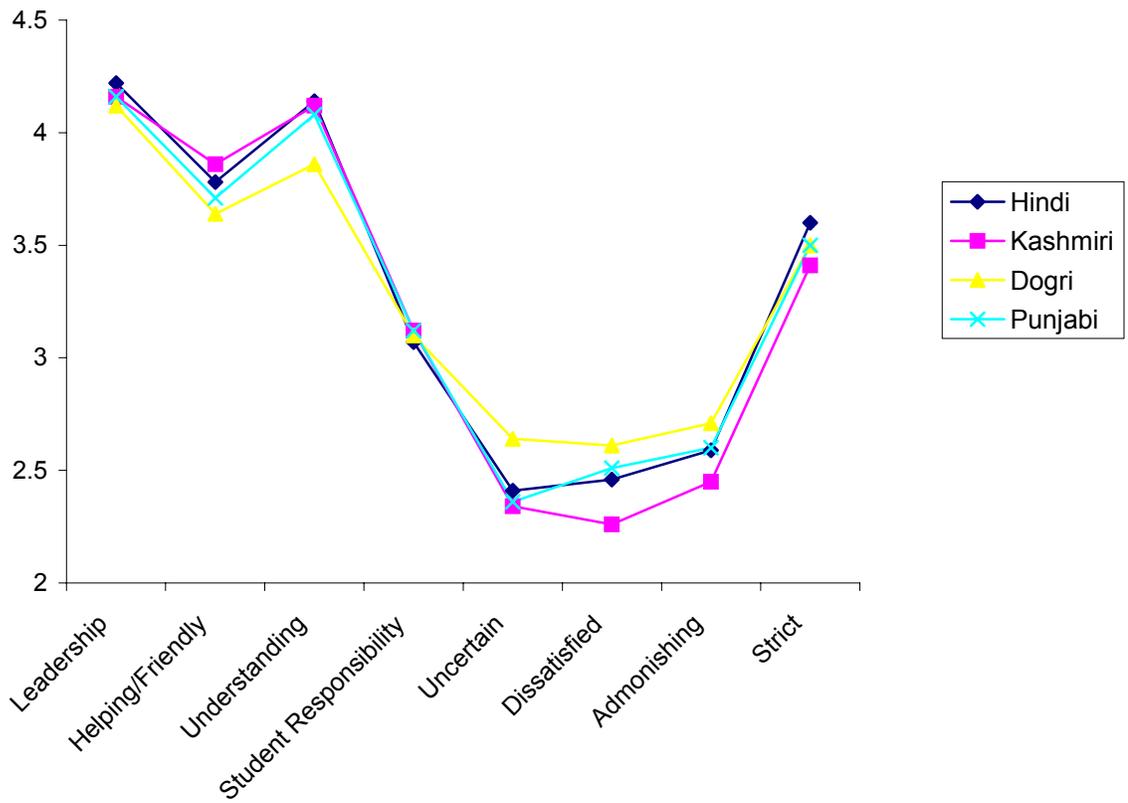


Figure 5.3. Means for cultural differences in students' perception of teacher-student interactions measured by the QTI scales.

5.4.2 Associations between Classroom Environment and Culture of the Students

Associations between perceptions of classroom environment and the cultural group of the students also were examined. The same four groups as used with the QTI, were used again.

Table 5.6

Item Mean for Cultural Differences (Language Spoken at Home) in Students Perceptions of Classroom Learning Environment as Measured by the WIHIC Scales

Scale	Hindi	Kashmiri	Dogri	Punjabi	F Value
Student Cohesiveness	4.23	4.15	4.08	4.06	6.77**
Teacher Support	3.52	3.51	3.43	3.41	0.93
Involvement	3.38	3.41	3.39	3.43	0.20
Investigation	3.42	3.47	3.36	3.40	0.76
Task Orientation	4.24	4.37	4.07	4.19	10.03**
Cooperation	3.95	3.98	3.81	3.83	2.91**
Equity	4.04	4.15	3.77	3.89	9.57**
	<i>n</i> = 522	<i>n</i> = 221	<i>n</i> = 175	<i>n</i> = 82	

** $p < 0.001$

Table 5.6 shows the scale means and F value for the scales of the WIHIC with the perceptions of the students from the four main cultural groups who constituted nearly 98% of the total sample. The purpose of this analysis is to establish whether there are

significant differences in the perceptions of students about their classroom-learning environment according to their cultural backgrounds. These differences can be seen in Figure 5.4.

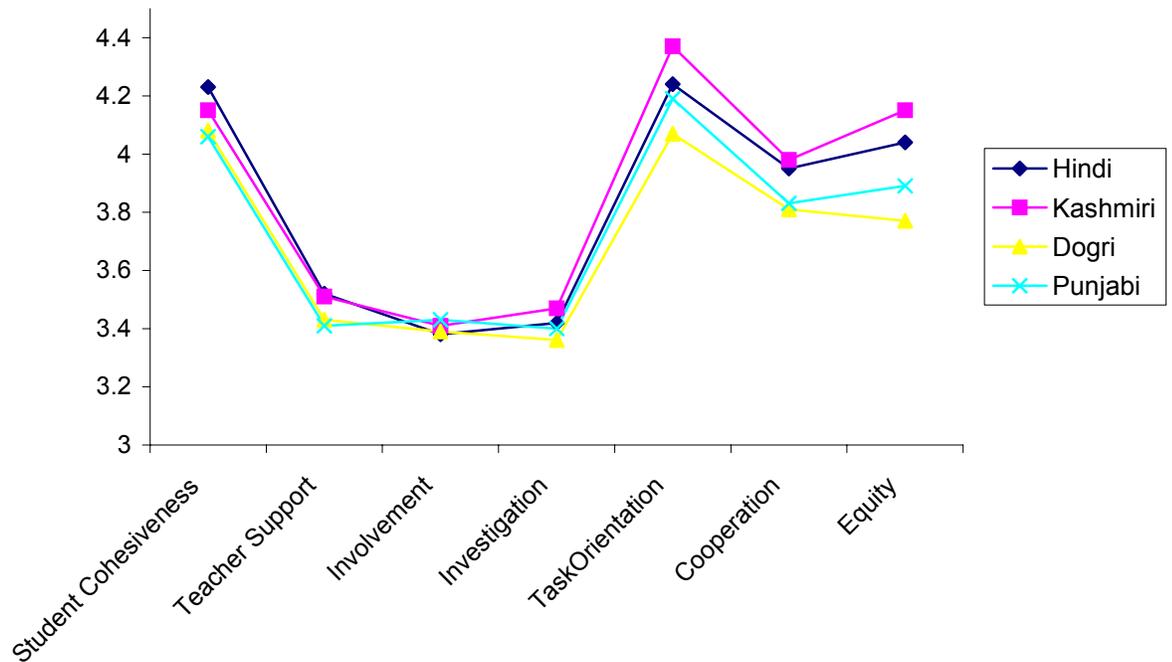


Figure 5.4. Means for cultural differences in students' perceptions of classroom learning environment as measured by the WIHIC scales.

Statistical analysis indicated that student perceptions on four scales out of seven of the WIHIC had statistically significant differences according to the cultural groups of the students they belonged to. These were the scales of Student Cohesiveness, Task Orientation, Cooperation and Equity. The Tukey's post hoc test ($p < 0.05$) revealed that, the students coming from the Kashmiri group had significantly higher means for Student Cohesiveness, Task Orientation, Cooperation and Equity scales. The Dogri group of students perceived their classroom environment as least on Involvement and Investigation than did the other three groups involved in the study.

5.5 RELIGIOUS DIFFERENCES

5.5.1. Associations between Student-Teacher Interactions and Religion of the Students

Next, the associations between teacher-student interactions on the basis of the religious faith of the students were examined. The students in this present study came from five different religious faiths, namely, Hindu, Sikh, Muslim, Christian, and Jain.

While examining the religious differences in the students' perception of the teacher-student interaction in the science classes, the within-class subgroup mean was chosen as the unit of analysis. In data the analysis, the mean scores for each of the five religious groups were computed. Table 5.7 shows the scale item mean and F value of the scales of the QTI with the perceptions of the students. The purpose of this analysis is to establish whether there are significant differences in the perceptions of students according to their religious backgrounds.

Table 5.7

Item Means for Religious Differences in Students' Perceptions of Teacher-Student Interactions Measured by the QTI Scales.

Scale	Hindu	Sikh	Muslim	Christian	Jain	F Value
Leadership	4.19	4.14	4.28	4.42	4.02	0.82
Helping/friendly	3.76	3.74	3.87	3.97	3.45	0.90
Understanding	4.08	4.07	4.11	4.46	4.02	0.94
Student Responsibility	3.10	2.98	3.15	3.32	2.69	1.70
Uncertain	2.45	2.35	2.23	2.19	1.97	2.25
Dissatisfied	2.46	2.43	2.42	2.17	2.14	0.63
Admonishing	2.59	2.59	2.51	2.26	3.45	1.26
Strict	3.54	3.57	3.54	3.45	3.50	0.10
	<i>n</i> = 883	<i>n</i> = 69	<i>n</i> = 48	<i>n</i> = 14	<i>n</i> = 7	

Statistical analysis establishes that there is no association between the perceptions of the students and their religious faith. Not even a single scale of the QTI showed a statistically significant difference.

5.5.2 Associations between Learning Environments and Religious Differences

Similarly differences in perceptions of students about their existing classroom-learning environment were investigated with WIHIC in the similar manner as for the QTI. The item means for each religious group were computed and Table 5.8 reports on these values. All the students perceived a high degree of student cohesiveness and task orientation in their classrooms. However, none of the scales of the WIHIC showed any statistically significant difference in the perceptions of the students on the basis of their religious faith.

Table 5.8

Item Mean for Cultural Differences in Students Perception of Their Classroom Environment as Measured by the WIHIC Scales.

Scale	Hindu	Sikh	Muslim	Christian	Jain	F Value
Student Cohesiveness	4.18	4.16	4.04	4.11	4.44	1.63
Teacher Support	3.50	3.42	3.39	3.75	3.21	1.10
Involvement	3.40	3.48	3.24	3.38	3.23	1.00
Investigation	3.44	3.47	3.25	3.09	3.12	1.80
Task orientation	4.23	4.27	4.28	4.19	4.37	0.28
Cooperation	3.93	3.85	3.90	3.98	4.08	0.37
Equity	3.99	3.93	3.90	4.52	4.10	1.81
	<i>n</i> = 883	<i>n</i> = 69	<i>n</i> = 48	<i>n</i> = 14	<i>n</i> = 7	

After analysing the perceptions of students on teacher-student interactions and classroom-learning environments, it may be concluded by the results of this study that religion does not have any effect on the perceptions of the students in India.

5.6 COGNITIVE ACHIEVEMENT

5.6.1 Associations Between Student-Teacher Interactions and the Cognitive Achievement of the Student.

Table 5.9 reports the simple correlation (r) and the standardised regression weight (β) between cognitive achievement and each individual QTI scale when all other QTI dimensions are controlled. Statistically significant associations were found with cognitive achievement and scales of the QTI. However it may be noted that associations between attitudes and QTI scales (see Table 5.1) were consistently higher than those values for the cognitive achievement as shown in Table 5.9.

The simple correlation (r) figures in the Table 5.9 indicate that there were only four significant relationships ($p < 0.05$, $p < 0.01$), out of eight scales of the QTI. These associations were only significantly positive for the scale of Understanding for student cognitive achievement. The scales of Uncertain, Dissatisfied and Admonishing displayed significantly negative associations. In summary cognitive achievement was higher where the teachers demonstrated more understanding behaviours and less uncertain, dissatisfied and admonishing behaviours.

An examination of beta weights reveals that three of the eight scales retained their significance. The Understanding and Student Responsibility/Freedom scales were positively associated, whereas the Dissatisfied scale was negatively associated with the cognitive achievement of the students. The R^2 figure in Table 5.9 suggests that 5% of the variance in student cognitive achievement can be attributed to teacher-student interpersonal behaviour.

Table 5.9

Associations between QTI Scales and Students Cognitive Achievement in terms of Simple Correlations (r) and Standardised Regression Coefficients (β)

Scale	r	β
Leadership	-0.00	-0.01
Helping/ Friendly	0.04	-0.03
Understanding	0.08*	0.09*
Student Resp/ Freedom	0.03	0.08*
Uncertain	-0.06*	0.05
Dissatisfied	-0.17**	-0.20**
Admonishing	-0.10**	-0.06
Strict	-0.02	0.04
Multiple Correlation R = 0.21**		
R ² = 0.05		

* $p < 0.05$, ** $p < 0.01$

5.6.2 Associations Between Classroom Learning Environment and the Cognitive Achievement of the Student.

Table 5.10 reports the simple correlation (r) and the standardised regression weight (β) between cognitive achievement and each individual WIHIC scale when all other WIHIC dimensions are controlled. Statistically significant associations were found with cognitive achievement and the scales of the WIHIC. However as with the QTI, associations between attitudes and WIHIC scales (see Table 5.2) are consistently higher than that of the cognitive achievement. Table 5.10 reports on the findings of the associations between WIHIC scales and the student cognitive achievement.

The simple correlation (r) figures in the Table 5.10 indicate that there were five significant relationships ($p < 0.05$, $p < 0.01$), out of seven scales of the WIHIC. All the associations are positive, for the scales of Student Cohesiveness, Involvement, Task Orientation, Cooperation and Equity. The simple correlation for the scales of the WIHIC varies from 0.05 for the scale of Student Cohesiveness and Cooperation to 0.14 for the scale of Task Orientation. Cognitive achievement was higher where the classroom-learning environment was promoting cohesiveness, involvement, task orientation, cooperation and equity.

An examination of the beta weights reveals three out of seven significant relationships. Involvement, Task Orientation and Equity scales each of which was positive. The R^2 figure in Table 5.10 suggests that 4% of the variance in student cognitive achievement is attributable to students' perceptions of their classroom learning environment.

Table 5.10

Associations between WIHIC Scales and Students Cognitive Outcomes in terms of Simple Correlations (r) and Standardised Regression Coefficients (β)

Scale	r	β
Student Cohesiveness	0.05*	-0.02
Teacher Support	0.00	-0.10
Involvement	0.12**	0.17**
Investigation	0.04	-0.07
Task Orientation	0.14**	0.14**
Cooperation	0.05*	-0.03
Equity	0.09*	0.05*
Multiple Correlations	R=0.19 R ² =0.04	

* $p < 0.05$, ** $p < 0.01$

5.7 CHAPTER SUMMARY

The quantitative data reported in this chapter represents associations between attitudes, gender, cultural background, religious faith and cognitive achievement with teacher-student interactions and the classroom-learning environment in India.

The results suggest that student attitudes to class were better when teachers exhibited more leadership, helping/friendly and understanding behaviours in their classrooms and were less uncertain, dissatisfied and admonishing. As for the classroom learning environment all the seven scales of the WIHIC had positive associations, but students perceived more positively teacher support, involvement and investigation. Gender differences generally indicated that female students perceived their teachers in more

positive way than did male students. For the cultural background indicator variables, students from Kashmiri backgrounds perceived their teachers in a significantly more positive way than did those from the other cultural groups. Religious faith of the students did not reveal any significant associations in the perceptions of students about teacher-student interactions or classroom learning environments. Though the associations for cognitive achievements were consistently smaller than those values for attitude to class, they displayed significantly positive associations for the scale of Understanding and negative associations for the scales of Uncertain, Dissatisfied and Admonishing in the QTI. The Student Cohesiveness, Involvement, Task Orientation and Equity scales of the WIHIC demonstrated positive associations with the cognitive achievement of the students.

The next chapter provides interview data collected from 64 students, two from each of the 32 classes where the quantitative data for the study were collected.

CHAPTER SIX

STUDENT INTERVIEWS

*Education: Being able to differentiate between what you do know and what you don't.
It's knowing where to go to find out what you need to know;
and it's knowing how to use the information once you get it.*
William Feather

6.1 INTRODUCTION

Examining schools and classrooms through a combination of quantitative and qualitative methods has provided a new direction for research in science and mathematics education. The use of a combination of two or more methods of data collection in the study of some aspect of human behaviour is called triangulation. By analogy, triangular techniques in the social sciences attempt to map out, or explain more fully, the richness and complexity of human behaviour by studying it from more than one standpoint and, in so doing, by making use of both quantitative and qualitative data. Cohen & Manion (1994) suggest that only a minority of studies have used it in practice. Although a few studies combining the two methods have been carried out in the last decade (Aldridge & Fraser, 1999; Fisher, Waldrup, Harrison, & Venville, 1996; Rickards & Fisher, 1999; Waldrup & Fisher, 1996), this study is unique in that it provides the results of the first ever study in India, using the QTI, the WIHIC and other data using both quantitative and qualitative data collection methods.

This chapter presents the interview data on teacher-student interactions and science classroom learning environments in Jammu, India. These data were obtained from interviews in an effort to validate the findings from the quantitative data. Two

students from each of the 32 classrooms observed were interviewed. The methods used to collect the interview data are detailed in Chapter Three.

Two items, from each scale of the QTI questionnaire and three items, from each scale of the WIHIC questionnaire, were selected to form an interview schedule (see Appendix E). During the interviews, students were asked to explain the reasons for their response to each of the items and, where possible, provide an example to clarify the point.

The data provided by the questionnaires gave me a platform from where interviews with students were conducted to help to explain the construct validity of the QTI and the WIHIC scales. The interview data have been grouped by each scale of the QTI and the WIHIC as primary data gathering tools, followed by the other outcome variables. The construct validity of these instruments is presented more clearly if the data are grouped in this way. Construct validity is “the degree to which a test measures an intended hypothetical construct” (Gay, 1992, p. 157).

The description of the each scale and sample items for the WIHIC and the QTI have been provided in Tables 2.1 and 2.2 respectively. In addition, Tables 4.5 and 4.9 provided the QTI and the WIHIC scale means and standard deviations. The mean for each scale of the QTI and the WIHIC for the total survey data sample is provided in the heading of each of the following subsections. The construct validation of the instruments is discussed in the following sections.

6.2 Construct Validation of the QTI Scales

6.3 Construct Validation of the WIHIC Scales.

6.4 Construct Validation of Attitude Scale

6.2 CONSTRUCT VALIDATION OF THE QTI SCALES

6.2.1 The Leadership scale (Mean =3.15)

Student interviews made it evident that the interviewees/students understood the description of the Leadership scale very well. High mean scores for this scale confirm that the students' perceived their teacher to be a good leader. When asked, 'why do you say that your teacher is a good leader?' they came out with most of the qualities which are listed in the leadership scale of the QTI. The following responses of the students given about the good leadership qualities of their teachers support the quantitative mean score.

** Tapasya: Yes, she is a very good teacher. She knows her duties well like teaching, controlling and leading us. Normally, there is not any mischief in the class and this is all due to her. If there are any problems she will sort them out very well.*

Arun: I like her mostly because she is in full control of the class. When she is teaching we (students) are all attentive and listening to her. She won't scold us if she finds that something is going wrong. Instead she will make us understand the difference between right and wrong and we know she is doing it for our good. We have full confidence in her.

Gurpreet: We don't have any problem with this teacher. Despite the fact our school is interrupted because of the curfews, still she completes the whole of the syllabus in time and explains the topics clearly. I wish even next year that I end up in this teachers class. She even corrects our homework and makes us aware of our misunderstandings about the topic.

*(To maintain anonymity all names of students given in the following transcripts are fictional)

Saleem: Yes, He leads us in the right direction and helps us in finding the right way. Like whenever we are stuck about any decision we go to him without any hesitation, and we are confident that he shall show us the right way.

Divya: He is overall very good especially with his lessons. He explains everything well, and I understand it and do not have problems like when I go home and need not to look for more help. He even controls the class without letting children get out of hand.

Naheed: She not only leads us well in studies but also leads us with day-to-day social and moral living. Before each lesson, she always gives us a thought for the day. It really leads us in the right direction.

Amarjeet: Well compared to other teachers, she controls the students well and everyone is listening to her and even if some one is inattentive in the class she won't scold that student. Instead she will make that student understand very gently. All students listen to her.

Jyoti: Well, he explains the things to us; he leads the class and keeps good discipline in the class. He also gives us freedom of thought like we are encouraged to do our work the way we want. Wish other teachers' too would be like him.

It was interesting to find students equating teachers' leadership behaviour with the way she/he conducts, controls and leads the class. The high mean score for the scale of leadership was reflected in the interview responses of the students.

On the other hand, comments from students for whom the teacher scored lower on the scale of leadership were consistently less positive and reflected their lower scores on

that scale. However, it may be noted that most of the students interviewed had positive comments about the leadership of their teachers. The less positive responses about the leadership behaviour of the teachers were;

Nisha: Yes, she talks tall but what we need is a teacher who would be able to control the class well. Some students, most of the time, disturb the class and she (teacher) does not know how to control them.

Rohit: Yes, he may be teaching well but he never is regular with our homework. He does give us homework but passing it on for correction is not compulsory. Good leaders do not call for such a quality. He is not leading us in the right direction.

During the interviews, students giving a negative leadership opinion about their teacher, were further given the definition of the leadership behaviour and asked if they still were supportive of their initial opinion. One of their responses was:

Yes, I fully agree with my first comment that he is not a good leader. He is not in good control of the class and yes other things may be fine. I cannot classify him as a good leader.

A few students gave an interesting interpretation about the leadership behaviour of their teacher. In their perception, the leadership quality of the teacher was not very important for them and it did not make much difference. They were only concerned about how well this teacher could teach which they believed would be reflected in their examination scores. One of these students commented;

Arjun: I don't think he is a good leader. In fact, he is not here to show his leadership qualities, he is here to teach us and we have chosen to study science and do well in this subject to get into the right course. Now that

we are in his class we have to make the best use of the time and his guidance. We have to get along well.

However, there were very few students who made negative remarks about the leadership behaviour exhibited by their teachers in the classrooms, which was consistent with the results of the quantitative data of this study. Students' comments in the interviews confirmed that their QTI scores for the scale of Leadership were consistent with their comments.

6.2.2 The Helping/Friendly scale (Mean = 2.28)

Teachers were perceived as helping and friendly in the classroom by some students, who were interviewed. Some interviewees commented about the enthusiastic behaviour of their teachers towards the science subject and the positive relationships created by their helping and friendly behaviour. But at the same time, other interviewees did not have a very positive perception of the helping and friendly behaviour of their teachers. The terms used by the students were generally consistent with the descriptions in the model for interpersonal teacher behaviour and their comments coincide with the findings of the quantitative data. Some of the students who perceived their teachers as helping and friendly suggested;

Jyoti: I feel he is not teaching for money. Teaching is his passion and he makes it a point that all our queries about the topic being taught are satisfied. He does it in a very friendly manner.

Nahhed: It is very easy to communicate with this teacher. She does know how to come down to a level of a student; after all at this stage we as students wont know everything. She also replies back in a friendly manner, she does not make fun of students if they are ignorant about any development in science.

Navjot: I like to do my work my own way and this teacher does not mind that. For my homework, I have the freedom to choose my own style and I find it possible due to the helping and friendly nature of this teacher.

Khalida: I know she is always helping and friendly. She goes around in a nice and cheerful manner and helps us out whenever we are in need.

Disha: Oh she is great. Good friendly, cheerful and helping. What else do we need? She is not like an old conventional teacher, who would scold and maintain a distance from the students.

Maintaining distance with students was associated with the approachability of the teacher. Some other students also commented about the positive helping and friendly behaviour by relating it to the approachability commented:

Arun: Whenever we need help we can go into the staffroom and ask her anything. She behaves in a friendly manner and we are not scared of her.

Tapasya: Yes it does help. Her friendly nature is very important to us. She does mean business, that is work should be done properly and in time but that too in a very friendly manner. For completing our work we can ask for her help and she does provide. It does make a big difference.

Tapasya's response on approachability of the teacher led to a question on teacher student interaction. In addition to Tapasya other students' also emphasised the fairness and honesty on the both sides as an important characteristic of the teacher-student interaction. She said:

I told you, she means business. She does help and she expects honesty from our side. She will go all out to help us, but if she finds out that we are not paying attention while she is teaching or we are not serious about

our studies she loses interest and pulls out. That is her nature but I feel it is fair on her part. She demands commitment from our side.

Some students who rated their teachers' helping friendly behaviours lower than average commented:

Rohit: Well, some students may find him very friendly, but he has not been the same for me. On the very first day of the school this year, he had a bad impression about me. Since then he has doubts about me. He feels I am not serious about my studies. Things would have been different if, he would be friendly towards me.

Nisha: Yes she is friendly but for only a few. We have the principal's niece in our class and she enjoys a very special status. She spends lots of time sorting out her difficulties, which in return affects us.

Sidhi: Sometimes more explanation is needed but she won't do it. If we ask her to do so she becomes grumpy.

Arjun: Our internal assessment for the board is to be given by him, so how can we complain. If we do so, he will not give us good marks and our overall performance will be affected. Otherwise I have never found him to be a friendly teacher. I try to do what he asks us to do.

Nisha: How can she help us all? She has such a big class. She has told us to see her in free time, but whenever we go to see her in a free period she is busy somewhere else. Probably overwork makes her unfriendly.

The student comments for the scale of Helping/Friendly suggest that the QTI is reflecting the perceptions of students about this behaviour of their teacher in the class. These comments are also closely associated with the QTI scores for this scale. A

medium level mean score is a result of a mixed perception about the behaviour of the teacher. The construct validity of the scale is supported by the responses.

6.2.3 The Understanding scale (Mean = 3.06)

The terms used by students to describe their teachers as understanding and to describe teacher-student interaction were consistent with those in the questionnaire. Student responses were generally positive about the understanding behaviours of their teachers. Some of the comments from students with high scale mean scores were:

Jyoti: Yes, he does understand us. Sometimes if we disagree with him we do talk about it with him and he does not seem to mind it.

Saleem: He fully listens to our views and goes through the part of the lesson again which we do not understand.

Amarjeet: She realises our difficulties, especially when we do not understand it first time, she explains it in a different way giving more elaborate examples, and making it clearer to us. Sometimes lot of time is lost in it but she does not push us. She works patiently.

The attribute of patience was appreciated by most of the students interviewed. This was most needed when students could not complete their assignments within the allocated time frame.

Gurpreet: Yes, she understands our difficulties. Especially with the problems these days, when school is closed every other day and we cannot complete assignments in time. She tries to be patient with us.

Sidhi: Yes, I don't have to worry about this teacher. Because of the political unrest if school is closed for few days and the last date for submitting an assignment is approaching, we don't have study material at

home. At such times, this teacher does not make a fuss about the last date for submissions like other teachers.

It was apparent that the teacher's attribute of patience prompted students to rank their teacher high on the Understanding scale. When talking about understanding, students interviewed in general made comments like:

Yes, she is understanding, listens to us, trusts us, tries to solve our difficulties and is patient. We can talk about our difficulties to her. She is open too.

Interview results reflected that students had a clear perception of the terms used in the Understanding scale. Students discussed their experiences with their teacher as reflected on their perceptions of the Understanding scale.

Very few students who were interviewed perceived their teacher behaviour as having little understanding. Less understanding teachers were identifiable in few schools. Some comments from students of these schools were:

Arjun: He thinks his way of teaching is the best. He is reluctant to repeat the explanation, if we don't understand it properly. May be he expects us to know the lesson before he has taught it.

Nisha: She teaches in a strange manner. It seems she has crammed up the lesson and she vomits it out in the class. This makes the class very boring and she does not understand it.

Students appreciated the understanding behaviour of their teacher especially when they were in difficulty and their teacher demonstrated a genuine caring and understanding behaviour. In most of the cases, students showed a positive perception towards the understanding behaviour of their teacher. The high mean score for the

Understanding scale of the questionnaire is consistent with the comments given in the interviews. This scale does appear to be assessing the understanding behaviour of the teacher.

6.2.4 The Student Responsibility and Freedom scale (Mean = 2.32)

Students rating teachers high on the scale of Student Responsibility and Freedom confirmed that their perceptions were consistent with the data from their questionnaires. These students felt that some strictness and control in the class is very necessary for the well being and smooth running of the class. It was reflected in the following comments:

Jyoti: He (teacher) cannot let us be fully free; you know how teenagers can be, especially when we are in the lab. Chemistry lab can be a big threat if students are not controlled. He manages it quite efficiently.

Khalida: She expects us to work seriously when we are working. No distractions. It can be disastrous. So she keeps a tight vigil and corrects any one trying to take a liberty. She does whatever is needed.

Divya: He cannot be influenced. He has his way of working and he decides what practical will be conducted by which group and also the student groupings. This way he distributes the students as well as the jobs.

Students having a low scale mean score on the questionnaire were consistent in that they made less positive comments about their teacher's interpersonal behaviour. Although they did recognise the hazards of working in a science lab, they still wanted a little more freedom. For example, some students commented:

Rohit: He treats us like year 2 students. We are mature enough to understand the dangers associated with science practicals. Especially working on chemistry or physics. He probably has no faith in us.

Nalini: She sort of is different. We have no say in this class. She wont let us out of the class when we finish our test or work. We have to be seated there till end of the class. It becomes very boring.

Shipra: Well, we don't get any responsibility. Most of the experiments he does himself, we only watch and record the readings. You can call it a demonstration and we students are just watchers.

Most of the students perceived their class as one, where the teacher had some control but they could have a say on deciding some things in the class. They agreed that full freedom in the class was not possible, but teachers who involved students in decision-making made the class more interesting so the students had a sense of responsibility towards whatever was going on. Some examples of such comments are:

Anshu: Um, I don't think it is really bad. He does ask us what and how we should go about the activities intended. This way we know what we shall be doing and we enjoy it.

Sanjna: She does it in a mixed way. We have limited responsibility and limited freedom. She makes it in the right balance. We do enjoy it this way and if some student misuses the freedom she deals with them in an appropriate manner.

Dinesh: It depends. Last week we were doing practicals on electricity. It can be quite dangerous. So the teacher had to keep a tight vigil. Before that when we were doing practicals on light, like reflection and refraction

she was quite relaxed. All of us know when ever appropriate she will give us responsibility or even freedom.

Students supported less freedom wherever they recognised danger in experimental sessions and appreciated the caution taken by the teacher. Student interview comments generally concurred with the QTI scores and supported the construct validity for the scale of Student Responsibility and Freedom.

6.2.5 The Uncertain scale (Mean =1.82)

It was interesting to find that probably because of the high Understanding score overall, students perceived their teachers as having a low uncertain behaviour. The same findings were reported in a previous study (Rickards & Fisher, 1999). This finding is reflected in the following comments made by these students.

Navjot: Like I told you, he is a good leader and he never puts us down. We also listen to him. All this is because of his confident behaviour. He never shows signs of uncertainty in his behaviour.

Divya: He has lot of experience and these years of experience have given him confidence. He is always very confident about what he is talking about, and he even listens to us about our views on that topic.

Khalida: As far as I am concerned, I have never found her uncertain. She is always confident and does not have many complaints with us. I feel she is quite happy with the way we are responding in the class. Her good leadership qualities also make us to listen to her.

Amarjeet: No, she does not impose things on us. If at times she feels that something is wrong, she will ask, like, if you are feeling well etc. While doing a science experiment or even while teaching she does ask why did that happen? I feel there is nothing wrong with that way of working.

Anshu: No, he never shies away. He even never hesitates to share his experiences with us. He has committed blunders but he does share with us so that we take a lesson from those experiences. This behaviour reflects on his confidence in himself first and then on us so that we learn right things from him.

Dinesh: She always knows what she is talking about but listens to our ideas as well. At times we have a better idea but that does not seem to put her down or faze her much.

Saleem: No, he is never uncertain. He knows what he is teaching and what end results he wants in the class. He makes us do what he has already planned to do in the class. He also answers all our questions without any problem.

Very few students rated their teacher's behaviour as uncertain. Some who did rate the teacher higher than the average mean score for the scale of uncertain suggested that:

Nisha: I don't think she is really confident of what she is teaching. Sometimes I wonder if she really knows the subject. She often makes mistakes and then apologises in the class. That is not a healthy way. She should come well prepared to the class.

Rohit: I feel teaching is not his cup of tea. He should consider changing his profession. Although he may be confident while teaching, he is checking his watch all the time in the class. Most of the time he finishes his lesson before time or at times gives us some sort of work.

Shipra: When he is not prepared for the lesson he gives us some work to do in the class. He may even say sorry.

Rashid: No, she is not timid. She is confident of what she is doing. She does make mistakes while teaching but apologises for the same and corrects her statement.

The uncertain teachers were mostly the inexperienced ones who entered teaching to make a living until they could find better paying work. This is a very common way of life in Jammu.

In general, students did not agree that it was easy to make a fool out of their teacher, but it was possible to get their way through being nice to the teacher and talking about things, which pleased the teacher.

Interview results revealed that the majority of the students interviewed perceived their teachers as highly confident and low in uncertain behaviour. These results were consistent with the results from the quantitative data from the QTI, which reported the Uncertain scale having the lowest scale mean (1.82) of all the scales for all the students.

6.2.6 The Dissatisfied scale (Mean=1.84)

This was yet another interesting scale to discuss as generally students did not perceive the behaviour of their teacher as expressing dissatisfaction. Some comments of the students who rated their teacher low on dissatisfied behaviour are as follows:

Tapasya: I don't think that she is dissatisfied with us anyway. She lets us do what we want and never questions our understanding or efficiency.

Jyoti: He seems to be very much satisfied with our work and if a student does not do well in the test he will have a friendly talk with that student and will explain the topic and in future will see to it that the student does not repeat the same mistake again.

Anshu: Oh no, he never ever criticises us at all and it means he likes us and does not have any problems with us. Whenever we have a problem or a question we directly approach him and he is the one who sorts it out.

Khalida: I have normally found her happy in the class. She never puts us down when we make mistakes. She has full confidence in our abilities.

Navjot: Well, sometimes he may be but not generally, he does not show dissatisfaction. He does not criticise us and doesn't seem to be unhappy with us.

Dinesh: No, she is not dissatisfied with us. She knows we work seriously and do well in tests. She has no reason to doubt us and be angry or unhappy with us.

Amarjeet: I don't think she is dissatisfied in any way, she gets along with most of us and it is the case with students too. She never seems to hold anger or anything like that for us.

Generally, students rated teachers low on the Dissatisfied scale. Students who rated their teacher higher than the average mean on the Dissatisfied scale commented as follows:

Nalini: Yeah, she may not be happy with us. She never responds back to our smile or when we wish her good morning, or when she comes to the class. Students normally feel good when the teacher responds back, but well she probably doesn't like us.

Rohit: He makes it a point that we are very quiet in the class. We spend a lot of time on this exercise. He never greets us in the beginning of the class.

Sidhi: No, she may not be very happy with us, we are not coming to her expectations. She would probably prefer us to be better.

Interview comments from students suggested that, overall, students perceived their teachers as exhibiting lower levels of dissatisfied behaviour. The terms used to support their comments were the same as in the QTI for the Dissatisfied scale. Students' responses during interviews were consistent with what had been reported by them on the QTI and supported the construct validity for the Dissatisfied scale.

6.2.7 The Admonishing scale (Mean=1.93)

The Admonishing scale was also well understood by the students and related to the terms in the QTI, like the teacher getting angry too quickly or unexpectedly or the impatient behaviour of the teacher. It may be noted that most of the students perceived their teachers to be exhibiting low levels of admonishing behaviour. Students by and large agreed that the teacher was getting angry with them for their own mistakes and even if they were scolded it was for their own good. They accepted the admonishing behaviour of their teacher as a routine matter. The following are the comments of students who rated the teacher as having a low scale mean score for admonishing behaviour:

Sadhna: He never takes his bad mood out on us. He is only angry when we have made a mistake.

Pamila: Normally, she does not get angry, but yes when she does get angry she makes it a point to take us to task. She is gentle but firm in getting things done. She never taunts or picks up on us.

Anshu: He knows how to deal with the class and he wont get angry if someone does something wrong. Instead he will help them out.

Tapasya: Ya, she does scold us but why should we mind it. She is doing it for our good. She has always been very patient with us. Sometimes she may show anger when we make mistakes.

Naheed: Well she doesn't get angry very fast, she does give warnings and waits but still if we don't follow a punishment is due.

When asked about the type of punishment the teacher would give, students made it clear that there was no corporal punishment being given but they reflected on the admonishing behaviour of the teacher. This can be understood by the following remarks:

Naheed: She asks students to leave the classroom and stand outside in the corridor. At times it becomes very humiliating as students and teachers from other classes come to know about the punishment being imposed. This is the way she shows her anger.

A small number of students perceived their teacher as exhibiting high levels of admonishing behaviours. They commented that they generally disliked it when their teacher got angry unexpectedly and for no reason was showing an unhappy face. The following are the comments made by the students who rated their teachers higher than the average mean score for the scale of Admonishing;

Sidharth: When she is in a bad mood it is reflected back on us. It is fine if we have made a mistake and she is angry. But if without reason she picks on us, no I don't like it.

Babita: No, he won't listen to even our genuine reasons. Last time I had a problem at home and could not complete my homework. Although I have always been submitting work in time, he could have excused me, but he passed a very sarcastic remark. Since then I am very cautious with him.

Rashid: It is fine if he only gets angry when we have made a mistake. He goes to the extent of calling me names and passing mocking remarks. He won't do it with all the students. He hates me.

When asked why his teacher would not pass mocking remarks on all the students, Rashid added:

I don't come from an influential family and am also not very good at studies.

This remark reflects the admonishing behaviour of the teacher who even resorted to favouritism. It may be noted that out of the total sample of 64 students interviewed only one student made this remark.

Students' remarks regarding their perceptions about the admonishing behaviours exhibited by their teachers were consistent with their QTI scale scores and supported the construct validity for this scale. The low to medium mean scale score (1.93) suggests that students do not regard their teachers as admonishing.

6.2.8 The Strict scale (Mean=2.65)

Students interviewed could easily conceive the meaning of the term "strict" and relate it to the behaviour of their teacher. Although the mean average for the Strict scale was in the high to medium range, not many students got offended with the strict behaviour of their teacher. Two students who accepted the teachers' strict behaviour commented as follows:

Navjot: We have to understand his position. He is responsible when we are working in the laboratory. Chemicals in there can be very dangerous. If he lets us free we may tend to be mischievous. We don't mind him being strict as long as he is friendly and a good leader.

Jyoti: Yes, he is stricter than most of the other teachers who teach us. But they are not teaching us science and we are not conducting experiments with dangerous chemicals. His strictness is to do with extra caution. He cannot leave us free.

Joyti's above comment clearly shows the relationship between the scale of Student Responsibility/Freedom (see section 6.2.4) and the strict behaviour of the teacher. This relationship was more evident in the following comment:

Disha: We can say she is strict. Once when we were supposed to have a test in science and we told her that we won't take it and she agreed. But on the other hand she gave us zero marks for the test. This was a very intelligent way of showing strictness in the class and putting responsibility of our deeds on our own shoulders.

The relationship between strictness and student responsibility is clear from these comments. The circumplex nature of the model for interpersonal behaviour, (see Figure 3.1) suggests that there is a negative correlation between the scales that are opposite, and this is the case with Strict and Student Responsibility and Freedom. Although it is clear that students are willingly to accept the strict behaviour of their teachers, there were a few students who perceived their teachers to be exhibiting stricter behaviours and commented on the need to maintain a balance between strictness and proper working order in the class. Students rating teachers high on the Strict scale commented as follows:

Rita: Oh, she is quite strict especially with homework and so. By now we know what she wants from us and we follow. A new student will crash because of her strictness.

Nalini: She is strict in the sense she has very high standards and sets very hard tests.

Arjun: We can't afford to talk in his class. He hates it and his way of marking the test papers is also very strict.

Rohit: He knows how to control the class. He sort of does not always shout at us but is quite strict with us.

Nisha: She is strict but she is stricter with some students, especially with those students who talk too much or didn't do well in the class test. I feel the teacher cannot let us always be free in the class but she sometimes goes overboard.

Divya: He is definitely strict. But it does not make any difference to me. I submit my homework and assignments in time. He is fine with me but anytime I am late I know he can get nasty.

The interview results confirmed that students understood the terms associated with the Strict scale on which they rated their teachers midway for strict behaviour. The interview data presented in this section support this view and further support the construct validity of the Strict scale of the QTI.

The construct validity of the QTI has been further supported by the interview data for all the scales. The quantitative data has also been supported and enhanced by the survey results. The mean scores for the different scales of the QTI generally coincide with that of the interview data. For example the leadership scale with the highest mean

score of 3.15 was supported as very few students interviewed had a negative opinion about leadership qualities of their teacher. Similarly the students perceived their teachers high in understanding (3.06) and low in uncertainty (1.82) and this too was supported by the interview comments of the students.

6.3 CONSTRUCT VALIDATION OF THE WIHIC SCALES

6.3.1 The Student Cohesiveness Scale (Mean=4.77)

Interview results supported the very high mean scores for the scale of Student Cohesiveness. Students perceived their classroom environments to be highly cohesive. They also clearly understood the scale and the terms used in this scale. Some students, keeping in view their own standing in the class, scored the items in this scale differently. Good students for example scored highly on the item, “I help other class members who are having trouble with their work” whereas those who were not very good academically rated highly the item “In this class, I get help from other students”. Some students’ perceptions about cohesiveness are reflected in the following comments:

Richa: We spend most of our time in school. In a way it is another home for us. I have no problems with most of my class fellows. In fact, we like each other for their own qualities.

Babita: Yes, we are all friends and I know all the students in this class. We have been in this school together for many years.

Navjot: Yes, most of the time we work like a team. Like when we have team assignments and when we have the class competitions.

Divya: We are like friends and we do help each other, but it is a little different when some girl needs help or a boy needs it.

When asked to clarify this point Divya said:

You see if I have a problem I will try to get help from a girl first. I usually avoid seeking help from boys. You know otherwise some sort of tales come out.

This comment shed light on the type of social system in Jammu. No doubt the schools are co-educational but still there is a clear distinction in the type of class membership for the students from different genders.

However, there is no evidence of any students' comments about low levels of Student Cohesiveness, which is being consistent with the results from the quantitative WIHIC data. Students' in the interviews confirmed that scores for this scale were consistent with their comments. The interview therefore supported the construct validity for the scale of Student Cohesiveness for the WIHIC.

6.3.2 The Teacher Support Scale (Mean=4)

This scale is intended to measure the extent to which the teacher helps, befriends, trusts and is interested in the students. In general, most of the students were positive about the support they were receiving from their teachers. Some students' perceptions of their positive teacher support is reflected in following comments:

Khalida: Yes, she is very supportive in the classroom. She knows our problems and goes all out to solve them.

Arun: She knows how to make us understand a topic. First she tries to clarify our doubts about the topic and then she will ask us questions on the same topic. It is really helpful. I wish other teachers would also do the same.

Saleem: Yeah, the teacher often tries to solve our problems. She will talk about our problems to us. It binds us together in a group. We have a sense of belonging.

Sadhna: No, we don't have any problems with her. She sort of helps us get through our problems. She makes each one of feel important.

Dinesh: Overall, she is supportive in the classroom. Like she shows her interest in each one of us but some time becomes indifferent to our feelings. Like while doing experiments if we have to show her something, she wont come to our seat. She will try to explain it from a distance and that time I feel as if she does not care about our emotions.

This comment was reflecting the feeling of the students who perceived their teacher to be less supportive than what they would ideally like him/her to be. A few other students who rated this scale lower than the average mean commented:

Shipra: Yes as far as teaching in the class is concerned he is OK. But, there is something beyond that, the human factor, it seems he has no mind for that. He never tries to work on that bond. He is indifferent.

Rshid: She is fine, as far as lessons are concerned, but she will never come and walk to us. Instead she is always on her dais sort of guarding the class.

These comments confirmed that students were looking for more teacher support in terms of getting close emotional security and acceptance from the teacher. Although their teacher was helping them with most of the work-related problems, the students would like it to be enhanced further.

The interview comments of students on the scale of Teacher Support were consistent with the mean scores from the quantitative data, thus supporting the construct validity of the scale for Teacher Support of the WIHIC.

6.3.3 The Involvement Scale (Mean=3.89)

Students' perceptions of their teachers' involvement in the class was well understood. The terms used in interview were consistent with those used in the questionnaire for this scale. Generally, students interviewed agreed that they were given ample opportunity to get involved in the classroom activities while some did differ in their views from their peers. Some typical comments from students with a high scale mean score were:

Saleem: After each lesson we do ask him questions about our doubts on the topic and he even accepts our opinions. This way he involves all of us.

Amarjeet: She encourages our active involvement in the class. She respects our views and we work out problems together. Sometimes we are asked to explain how we solved a problem and the teacher does it at random. All students get a chance to express their views.

Navjot: Yes, he does ask me to explain how I went about solving a particular problem. We even discuss it with our class fellows. It is very helpful.

Disha: We have a science debating club, and all students in the class have to be a member of this club in either the first half or the second half of the year. This way all of us get involved directly in the scientific enquiry intended.

Arun: Debating involves all of us. Both parties, speaking for or against the notion. Each group works very closely.

Jyoti: Yes, he can at anytime ask me to explain how I solved the problem or if questions related to it. We have got to be ready.

Although most of the students interviewed perceived positive involvement in the class, there were a few students who perceived that there was room for improvement in regard to their involvement in the class concerned. Students who scored lower than the average mean score on the scale of Involvement commented as follows:

Nalini: When we are doing practical work, she doesn't let us do it on our own. Probably she fears something wrong is going to happen.

Rohit: Not every one can explain in the class. Only good students have the privilege of doing so. We will be made fun of, if we make a mistake.

Sidharth: She does ask questions at the end of each lesson. That time she is running out of time and she prefers to ask questions to only front-benchers who give her the right answers.

With regard to the scale of Involvement, some students felt that they were left behind and only a few students were involved. In general, interview comments for this scale suggested that the WIHIC is reflecting the perceptions of students well in that students' high scores on the Involvement scale were consistent with their comments. A students' high scale mean score generally resulted in a positive comment regarding their perception of their involvement in the class. The construct validity for this scale is generally supported by student comments.

6.3.4 The Investigation Scale (Mean= 3.89)

This was a very interesting scale to discuss. Most of the students perceived science to be an investigation-based subject and investigation was perceived in terms of practical work in the laboratory for researching the study material or engaging themselves in

discussions with their peers, teacher or another person. Some students who scored high on the scale of Investigation commented as follows:

Tapasya: Once a week we have a practical class and we are shown changes taking place etc., practically.

Gurpreet: I make investigations by studying the science book or some other study material about the topics we study at school. Sometimes I use this information to solve problems.

Naheed: You see, sometimes certain facts like plants giving out carbon dioxide at night was puzzling me or water expanding on freezing. I did investigate these facts at home and now I am convinced that the teacher was not wrong.

Pamila: We do go home and try to find out answers to the questions asked by the teacher. Most of the time these answers are in our science books but we need to investigate.

The interview results indicated that generally students perceived their classes as having high levels of investigation. There were a few students who perceived little opportunity for investigation in their science classes. Their responses to the questions on the scale of Investigation were as follows:

Sidhi: We are never allowed to carry out lab-work on our own. She comes and directs us to do what ever we are supposed to do and even tells us before hand what is going to happen. It is more of a demonstration than an investigation.

Babita: Oh while discussing a topic there are many scientific procedures we discuss. We don't have time to investigate them. We investigate what ever is in our course; the rest is waste of time.

Rashid: You see these days with the disturbances in the city we don't have school daily. If the school is closed on a practical lesson day then we can't do it. Sometimes he (teacher) demonstrates. It is not sufficient although it is the real science.

Interview results generally indicated that students considered investigation to be the best part of science lessons and would prefer to have more of it. The mean scores for the scale of Investigation in the WIHIC indicated that students perceived the activities encompassed by the Investigation scale as occurring between sometimes and often. The interview results also support the same view. It appears that the Investigation scale of the WIHIC has the ability to assess the perceptions of students regarding their science classroom investigative learning environment, thus supporting its construct validity.

6.3.5 The Task Orientation Scale (Mean=4.84)

High mean scores for this scale indicated that students in this study perceived their classes to be highly task-oriented. This scale has the highest mean score out of all the seven scales of the WIHIC. Interviews revealed that students in this study would receive a course content booklet at the beginning of the year, which was to be covered by the end of the academic year. Students were also given the topics, which would be completed by the end of each term. Some students' perceptions of task-orientation in their classes is reflected in the following comments:

Sadhna: You see it is very easy. For example, we knew that in first term we were going to do light and electricity for Physics. The sequence of the topics for these chapters is given in the book and the teacher follows it.

Nalini: Ya, I do try to understand work in science because I know if I don't work well, I mean work consistently, that is not going to be good for me.

Shipra: He does let us know in the beginning of each lesson, what he is going to teach. He does not speak out the goals but it is sort of understood.

Amarjeet: I know that if I do not understand the basics of science well, right now, how can I do well in science later in my life. I am trying to make my base strong and clear about the science. This understanding will also let me perform well in the examination.

Anshu: I am always attentive and keep working during science lessons and the teacher encourages this.

The interviews indicated that goals although not mentioned daily, were usually clear. Also students were attentive and tried to understand the content of each lesson, as this was the only way to get good examination results. It seems that the emphasis on good examination results has resulted in creating a highly positive perception about task orientation in the students. Students' comments are in agreement with their WIHIC scores for the Task Orientation scale and thus support the construct validity of the scale.

6.3.6 The Cooperation Scale (Mean=4.49)

Students were able to identify well with the terms used in the Cooperation scale, such as "students work with me to achieve class goals" and generally suggested that there was a high level of cooperation amongst students in the class. The students' linked cooperation with good interpersonal skills and achieving the set goals. For example, the following comments from students who rated the class highly on the Cooperation scale were common and reflected general student opinion.

Pamila: We have to work in groups whenever a group assignment is given. All the group members share some responsibility and that way it becomes easy.

Dinesh: You see, if I have a good article in some book I show it to my class fellows we discuss it and whenever they have one they will also do the same. This usually happens for assignments otherwise all of us have the same science book.

Jyoti: We do work together and get to learn from each other.

Navjot: Yes, we have been sharing our notes on science. I do cooperate with other students in this class.

Babita: Working cooperatively is the best part I like in this class. All the students believe in cooperation and sharing.

Students' comments were consistent with their WIHIC score on this scale and hence supported the construct validity for the scale of Cooperation.

6.3.7 The Equity Scale (Mean=4.57)

The quantitative data indicated students perceived that their teacher generally treated them equally. Students interviewed were able to relate to this scale as they understood quite well the description of the scale. When students were asked, "Why do you say that your teacher treats you all equally?" they were supportive of the terms used in this scale. The following comments exemplify those of students who had scored a very high-class mean on this scale, i.e., the students reported that their teacher was treating them equally:

Khalida: Oh, she is very fair. She will attend to all of us equally. Like when I ask her a question she pays me an equal amount of attention as she would pay to other students.

Navjot: In the class, I have same amount of say as do other students in the class. We are students of the same class.

Disha: See we are all members of the same group, so why should the teacher or some students discriminate. We are all treated equally, given equal attention and help. My view has the same say as any other students in the class.

Shipra: He knows very well how to appreciate our work. He does it equally for all the students. It is direct encouragement for all of us.

Rita: He visualises the amount of time and effort we have spent on doing an assignment. Accordingly, he will appreciate and encourage all of us.

Nisha: Doing well means getting praise and it holds good for all the students in this class.

Gurpreet: See if I don't concentrate on my work, the teacher will scold me. But she will do the same for other students when they are not concentrating. It means she treats us all equally.

Saleem: Whenever we have a class discussion, all of us are encouraged to participate equally.

The above-mentioned comments were given by the most of students reflecting on the equity in the class, but there were a few students whose mean scores for this scale

were lower than the average. These students made the following comments when asked if they considered their classroom environment to be offering equal opportunities to all the members of the class:

Nalini: It depends who is asking the question. If it is a good (academic) student she/he will get all the help, but if a poor (academic) student asks the same question she/he will be scoffed at for the same question.

Sidharth: Last assignment we did jointly in the groups of five and, each one of us submitted our reports. There was practically no difference in the report submitted by all five of us. But he (teacher) praised only one report a lot. It was from a topper that was the only difference.

While most students commented that all of them were getting equal attention and opportunities in the class, the comments from students generally supported the responses that they had given on the questionnaires. The scale therefore does appear to be assessing the equity in the class.

The validity of the WIHIC is further supported by the construct validation of the instrument for use with the Indian sample. The high mean scores for all the scales of the WIHIC conveys a very positive classroom environment in India which was further supported by the students' interview comments. The highest mean score for the scale of Student Cohesiveness (4.77) was supported, since none of the students interviewed made a single negative remark about the items in this scale. The mean scores on the scales of Involvement and Investigation, both having a mean of 3.89, were also supported by the comments of the students. Generally, most of the students perceived these items positively, but a few students felt that they were being left out and not involved and a few other students would have preferred activities and opportunities in their science lessons. Generally, the student comments supported the mean scores for the WIHIC thus supporting the construct validation of the WIHIC, and helping in the interpretation of the quantitative results.

6.4 CONSTRUCT VALIDATION OF THE ATTITUDE SCALE

6.4.1 The Attitude Scale (Mean=4.15)

The results based on the quantitative data indicate that the students have a very positive attitude towards their science lessons. They made comments about lot of interesting fun work in the class. The following are some of the comments given by most students about their attitude towards science classes.

Tapasya: I enjoy my science classes and look forward to it.

Navjot: Science classes are fun especially when we do experiments.

Pamila: This class is one of the most interesting ones. In class, the teacher explains with the help of either diagrams or colourful charts or specimens, making the class interesting. Monotony, as in other subjects, is broken here.

Jyoti: Science is a very important subject and there is a lot to be learnt. How can I get bored with this subject?

Dinesh: There is lot of competition at the school and I have to take interest in the science lessons. When I understand a part of a topic I become curious about the next part. It is interesting.

Rohit: I enjoy science because it is a practically based subject and we get to do assignments.

Generally, students had a very positive attitude towards science classes. Some students whose mean score on the Attitude scale was lower than the average mean commented as follows:

Sidhi: Ya, it is OK. I am not science type of a person I am more into history and I enjoy that more.

Arjun: I am not going to make oxygen for a living. So why waste time on science. I have to read it and I am doing so.

The interview results revealed that most of the students who disliked science lessons were generally lower-ability students. Good students (academically) enjoyed the science lessons.

A notable point was that student interviews were generally reflective of the description of student perceptions as provided by the Attitude scale. This suggested that the Attitude scale data provide a basis for measuring students' attitudes towards the science lessons. Overall, the interview data supported the fact that students interpreted items in the ways that were consistent with their Attitude scale score. This suggests that the Attitude scale has an ability to measure students' attitudes in India and thus supports the construct validity of the scale.

6.5 CHAPTER SUMMARY

Semi-structured interviews based on the questionnaire items were conducted with 64 students, two from each class in the sample. Students for the interview were chosen at random. Interviews were used, firstly, to help to gauge whether students had interpreted the items consistently in keeping with my (researcher's) intentions and, secondly, to provide explanations for the mean scores. The pattern from the qualitative data was consistent with the students' view expressed through the questionnaire data. The construct validity for the QTI, the WIHIC and the Attitude scale was supported by the qualitative data presented in this chapter. For example, students who commented on their teacher as understanding during the interview were in fact the same students that scored high scale mean score on the QTI scale of Understanding.

This was a consistent pattern for all the scales of the QTI, the WIHIC, and the Attitude scale.

A notable point was that student interviews were generally reflective of the description of student perceptions as provided by the Attitude scale. Overall, the interview data supported the fact that students interpreted items in the ways that were consistent with their attitude scale score. This suggests that the Attitude scale has an ability to measure students' attitude in India and thus supports the construct validity of the scale.

These findings reinforce the notion that the QTI, the WIHIC and the Attitude scale are reliable, valid and useful instruments that can be used with confidence in Jammu, India. Teachers who wish to reflect on their teacher-student interactions and science classroom learning environments can also readily use these instruments. The next chapter provides information observed during the data collection. This is in regard to the socio-cultural-economic and political climate of Jammu (India), which might affect student-teacher interactions and science classroom learning environments.

CHAPTER SEVEN

CLASSROOM OBSERVATIONS

*Nothing has such power to broaden the mind
As the ability to investigate systematically and truly
All that comes under thy observation in thy life.*

Marcus Aurelius

7.1 INTRODUCTION

For as long as people have been interested in studying the social and natural world around them, observation has served as the bedrock source of human knowledge. Observation is one of the earliest and most basic forms of qualitative/social research, and it is also, very often used in conjunction with other forms of research, such as questionnaires, surveys, experimental studies, and interviews. Social science researchers study their surroundings regularly and repeatedly, with curiosity spurred by theoretical questions about the nature of human action, interaction and society (Adler & Adler, 1994).

Conducting observations, in each of the 10 classes selected, further validated the data collected for the present study. I observed each class for two 30-minute periods. These observations were made to further understand the findings from questionnaires and interviews about the teacher-student interactions and science classroom learning environments in Jammu, India. The methods used to conduct these observations are detailed in Chapter Three.

Emphasis was placed on direct observations, both in the classroom and laboratory laying standard emphasis of the usability approach observing users perform genuine

tasks in order to inform design. My goal was to be able to articulate a clear set of scenarios that captured the flow and sequence of classroom observations experienced by me, the researcher.

The data provided by the questionnaires and interviews provided the basis for clarifying my findings about the teacher-student interactions and classroom learning environments in Jammu, India. One of the hallmarks of observation has traditionally been its non-interventionism. Observers neither manipulate nor stimulate the participants. They do not ask the participants research questions, pose tasks for them, or deliberately create new provocations. Simply, the observer follows the flow of events. Behaviour and interaction continue as they would without the presence of a researcher and interruption by intrusion (Adler & Adler, 1994). Observations in the present study were conducted with the same principle. At the same time, I made an attempt to recognise my own researcher's influence on the study. This was the stage when I realised that after making observations, I should write a full account in my field notes as soon as possible. Finally my observations of the classroom are represented in the form of two stories in this chapter.

While writing, I struggled with the issue of the classroom participants and how to represent the participants in a socially honest manner in the written text. There is an acknowledged difficulty with representing the experiences of others (Stacy, 1988). Stacy further argues that, despite the desire to 'engage in egalitarian research' (p. 25), there is a contradiction in the power relationship between the researcher and the subject that will always pose a risk of betrayal in manipulation. Denzin and Lincoln's (1994) description of the 'fifth moment' in qualitative research reports issues associated with the crisis of representation and legitimisation. To address these issues, I did two things. First, I ensured that the quotes included in my stories were in fact, spoken by the people portrayed. Second, I placed myself within the text of the descriptions. In doing so, I acknowledge that these stories and subsequent commentaries are, in fact, my interpretations of situations, experiences and interviews.

I attempted to address the important issue of legitimation in the writing of the texts in three ways. First, I triangulated data from different sources, following Denzin and Lincoln's (1994, p. 2) advice that:

...the use of multiple methods, or triangulations, reflects an attempt to secure an in-depth understanding of the phenomenon in question. Objective reality can never be captured. Triangulation is not a tool or a strategy of validation, but an alternative to validation.

Second, I asked members of the group involved, the teachers and students observed, to read the stories to verify their authenticity. Third, I attempted to represent those whom I observed, using verisimilitude (i.e., to resemble truth or reality), which was done in the form of educational criticism.

7.2 EDUCATIONAL CRITICISM

This chapter takes the form of an educational criticism (Eisner, 1994), in which I attempt to shed light on the teacher-student interactions and science classroom learning environments in Jammu, India. Educational criticism, a form of educational inquiry, is qualitative in character and 'takes its lead from the work of critics in literature, theatre, film, music, and visual arts' (Eisner, 1994, p. 212). In educational criticism, the critic's task is to render the qualities of the classroom into a language that will help the reader to perceive those qualities more deeply.

Educational criticism revolves around four main aspects. First, descriptions enable the reader to participate vicariously in the auditory and visual qualities of life in the classroom as represented in this chapter. In this way, 'an attempt is made to identify and characterise, portray, or render in language the relevant qualities of educational life' (Eisner, 1994, p. 226). In this chapter, narratives based on my observations of the socio-cultural, political and classroom life have been used to make sense of how social and cultural factors might affect the existing student-teacher interactions and classroom learning environments.

The presence of a certain socio-cultural and political atmosphere in the Jammu city in this study was considered important because students from different ethnic backgrounds socialise according to different family beliefs, values, expectations and norms (Salili, 1996). Political unrest and political disturbances in Jammu as declared by the Government of India, are also making their mark on the budding citizens (students). The composite stories of life outside the classroom (section 7.2) and life in the classroom (section 7.3) are based on a number of observations and experiences made over time, in an attempt to portray the cultural archetypes in Jammu, India.

The second, or interpretative aspect of educational criticism, is related to the concept of “thick description” as used by Geertz (1973, p. 5) in anthropology: “it is explication I am after, constructing social expression on the surface enigmatical”. The work of the critic, then, is to seek the structure and meaning behind social events, or the rules that give them order. The interpretative aspect of this chapter examines the situations rendered in the descriptive phase, providing a second layer of representation (Geelan, 1997) and is constituted by a commentary that follows each story.

The third and fourth aspects of the educational criticism distinguish the work of the educational critic from that of the social scientist. In this way, the researcher (educational critic) takes the seat of an evaluator and examines the values assigned to an educational process. In this chapter, these values are discussed in themes drawn in relation to teacher-student interactions and classroom environments, which involved the distillation of the major ideas or conclusions that have emerged from the research. The findings of the observations are discussed in the following three sections:

7.3 Life outside the classroom.

7.4 Life in the classroom

7.5 Discussions

7.3 LIFE OUTSIDE THE CLASSROOM

Considering both questionnaire and interview data, I found that students in Jammu, India appeared to have a very positive attitude towards their interaction with teachers and science classrooms. Furthermore, my recent experience of living with my relatives and friends for about a period of three months gave me an insight into how the academic attitudes of students might be fostered and influenced outside classroom. According to Goodnow, Burns, and Russell (1985) and Marjoribanks (1987), the family environments of students could affect their achievement at school. The story, which follows, is a description of a day's life in one family living in the politically disturbed city of Jammu.

The purpose of examining the life outside the classroom of the students was to help me to deepen my understanding of socio-cultural factors and their influence on the student-teacher interactions and learning environments. The story portrayed here is to show a sharp difference in the lifestyle of the same family in two different circumstances. The story is followed by an interpretative commentary aimed at placing the descriptions in contexts within which they were portrayed.

The composite story, which follows, is based on my experiences with a family who have been my friends, as well as on my own experiences as a resident in India. Whilst the generalisation of insights gained about any one family is limited, there are some aspects that could be considered fairly typical of the life, of a middle class family in Jammu, (India).

7.3.1 Story 1. Life Outside the Classroom:

I was awakened by the rattling of temple bells on one side and on the other side the sound of the azan coming from the mosque. I did not feel fresh enough to get out of bed. I checked my watch in the dark and was surprised to find that it was just past four a.m. in the morning. For me, it was too early to get out of bed so I decided to sleep for a few more hours. The music of

devotional songs, probably being played in the temple was loud enough to keep me from sleeping. I was enjoying the music and at the same time struggling to sleep, so that I could start my day fresh.

Next I was awakened by the sound of music being played in the house. Once again I checked my watch, it was six am in the morning. I heard the rattling of dishes in the kitchen. I forcibly pulled myself out of bed. The room was quite cold so I wrapped a shawl around myself and switched on the lights. When I came out of the bedroom, I saw my friend Rita coming out of the kitchen with a tray of cups filled with hot tea. By now she had taken her morning bath. Other members of the family were still in their beds waiting there for their morning cup of tea more commonly known as the bed tea. I was asked to stay in my bed as it was cold outside (protocol), which I decently refused and took a seat on the dewan (furniture used for sitting) in the living room more commonly known as the lobby.

This room adjoined the kitchen on one side and the drawing room (lounge room) on the other. It was furnished with a beautiful Persian wool carpet with big square cushions kept along the wall in one corner. The family spends most of their time sitting on this carpet. The other side had a dewan and a dining table. To me, this dining table was more of a storage shelf with water bottles, fruit baskets and dry fruit trays on it. In the corner, between the dewan and carpet, was a TV trolley carrying a television set, a music system and a few decorative articles. This room was the most frequented place in the house. Rita's husband uses the drawing room only when his official guests visit him at home.

Once again I saw Rita coming out of her parents-in-laws' bedroom after giving them their morning cup of tea and then entering her bedroom. She asked me to join her, which I reluctantly did. She woke her husband Ravi, and handed him a cup of tea. Both of us joined him as he switched on the radio to check the latest news. It is a normal practice with the public in Jammu, to check the news in the morning before they plan their day.

Once Rita knew that her children would have a normal school day she left her half a cup of tea behind and rushed to the bedroom of her fourteen-year-old son Ashu and I followed her. Very

respectfully and lovingly she whispered “good morning” and, “time to get up” in the ears of Ashu. Ashu was sleeping tightly bundled up in his quilt and a blanket, which had fallen on the floor, probably during the night. He must not have been able to manage his bedding at night and was trying to warm himself up. According to Rita, he had no time to think but to get out of bed and get ready for school. On the other side of the same room Feroz (whose bedroom I was using) is sleeping. By his movements, I could see that he was fully aware of the happenings in the room but was enjoying his sleep until he would be asked by his mother to get up. No one wants to leave a warm cosy bed on a chilly winter morning but school timings were such that no one can help it. No sooner than eleven-year old Feroz was asked to come out of bed and get ready for school, than he did it.

I could see that both the brothers with sleepy eyes opened their cupboards, pulled out their school uniforms and entered the bathrooms. Strangely enough, even on this cold chilly morning, both these boys had their morning shower before leaving for school. Feroz called his mother from the bathroom. There was a problem; his mother had forgotten to switch on the geyser the previous night. Rita knocked at the bathroom where Ashu was bathing and asked him to be fast and use less water. This was a very chaotic scene. They could not use water generously as even the electric supply was rationed and there would be an electric cut from eight am till eleven am. All the members of the family should take a bath before that time and only one bathroom had hot water. Some how they knew very well how to cope up with such a crisis.

There was a bell sounding at the main door and as I did not see any one around I opened it. It was the family helper Kailash who lived in the outhouse specifically made for the helper of the family. Once he was inside the kitchen I could hear Rita delegating jobs to him, as she also had to leave home soon for her work. She teaches at the local undergraduate college.

It was ten minutes past seven in the morning and I could see Ashu coming out of his room dressed smartly and neatly in his school uniform comprised of a white shirt, grey pants, grey jumper, blue blazer and a blue and grey striped necktie. His waist belt had the same pattern as his necktie. The blue blazer had a school logo on it. As soon as he came out, Rita personally

handed him a hot cup of chocolate milk and a tiffinbox which had sandwiches inside it. Tiffin is supposed to be eaten at lunchtime in school. Meantime, Feroz also received the same treatment as Ashu. At about 7.30 am the boys were ready to leave for school and their father Ravi drove them to the bus stop where they would catch their school bus. This time I asked Ravi to buy me some Kashmiri bakers' chot (bread) which we could have for the breakfast. This chot was a sort of a novelty for me and I wanted to have it fresh. Since Ravi had to go to the baker, he asked me to join him so that I could have the chot as soon as it comes out of the tandoor (wood-fire oven). This chot is the standard cereal for an average Kashmiri breakfast.

The children's bus stop was nearly 200 metres from their home. At the bus stop children were chatting in small groups as well as waiting for the bus. Ravi waited too, and on arrival of the bus the children queued up neatly before going inside. We drove off to the baker.

By the time Ravi and I arrived back, Rita was ready to leave for her work. Her parents-in-law had also joined us the lobby and were sitting down on the woollen carpet with blankets on their legs. Her mother-in-law was also holding a kangri (fire pot) in her hand. She passed this kangri on to me and I really enjoyed the warmth. By this time the electric supply had been shut down. I was asked to get ready quickly so that Ravi could drop me at a school where I was supposed to go for my data collection. Soon after a quick breakfast of Kashmiri chot and tea we left. Ravi first dropped me at the school and then Rita at her college, before heading for his workplace. This was a special day for Rita, as normally she travelled by public transport.

At about 3.30 p.m. in the afternoon Rita came to the school where I had collected my data and we both take the public transport to go home. This was a crowded mini-bus. On reaching home, we were served hot tea with snacks by Kailash, and Rita's parents-in-law joined us. Feroz had already reached home on the school bus at about 2.30 p.m. He was taking a nap after eating lunch. Kailash had served lunch under the strict vigilance of the Grandmother. Soon I found Rita in the kitchen giving instructions to Kailash about dinner. Ashu had gone to have private tuition and would return home later.

By five p.m. Feroz was awake and Rita joined him in his room where I was checking my questionnaires. First of all, Rita checked his school diary, then she helped him with the homework, at the same time correcting him whenever he made mistakes. It was winter, and days are short and it was pitch dark outside. Rita went out to the lobby room where the television was situated to check the latest news and returned with a worried face. There had been a bomb blast in the main market. Ravi and Ashu were still out.

She quickly made a phone call to Ashu's tutor's home and was told that his father had picked him up few minutes ago. The whole family gave a sigh of relief but still signs of concern were evident on the faces of each member. They were divided between either watching the news and condemning such acts and looking for the arrival of the family members who were still out with a big question mark about their safe arrival back home. The family started calling and receiving phone calls from members of their extended family and friends, enquiring about the welfare of each other.

At about 9 p.m. we heard the car pulling up in the driveway. Everyone was relieved when the father and son walked in. The police had stopped them for some time due to interrogations going on about the bomb blast. The bomb had blasted a busy shopping area where people were shopping for fruit and vegetables in the evening. It had claimed five innocent lives and more people were injured. The atmosphere in the home was depressing for a while, but soon everybody was again doing his or her jobs. Rita was in the kitchen fixing dinner, Ravi and Ashu had gone to their rooms to change and I along with Feroz and his grandparents were watching TV. A sheet was fixed on the carpet and dishes of mutton, vegetables, rice and yoghurt were served on the sheet and grandma fixed dinner in the plates. After the dinner, Ashu was asked to get up and study, which he would do until late in the evening, about 11p.m. It was clear that there would be no school for the boys tomorrow and no work for Rita and Ravi. The kitchen store was checked to make sure that there was enough there for the next few days, as the shops would probably not open. We all sat down for a while had a family chat and later on had some fruit before retiring to our beds.

To Rita and Ravi, the education of their children is extremely important. To a great extent, their lives revolve around the family of which the children's welfare plays a very important role. Ashu and Feroz were sent to a private school since their pre-primary education. Both of them attend the same school. The parents' willingness to spend a lot of their earnings on the school fees of their children, in addition to paying for the private tuition of their elder son, reflects the desire of parents for their children to do academically well which according to them is the only way to success in life. In addition to all of this, Rita is personally supervising the education of her younger one and also guides Ashu whenever he needs some help. Feroz shall also be starting private tuition from next year. When asked during the family chat in the evening about the course their children would be taking up once they are in University, all the members of the family had a common consensus that both the boys should take up a professional course. The parents were even saving to pay a large capitation fees if the need arises. (Students of private professional colleges who do not make it into government colleges pay Capitation fees). The fees in government colleges are very nominal. The option of not taking up a university degree is unthinkable. Parents see education as the chief means for securing their children's advancement in today's fast changing knowledge-based society. The grandfather of the family was a retired headmaster and said, once Aristotle was asked how much superior were educated men to the uneducated. 'As much' came the reply 'as the living to the dead'. According to him, the significance of education for humanity cannot be expressed better.

Rita's views about the methods of teaching in schools were not very positive. That is why both her sons' education was being reinforced either by a private tutor or by guidance at home. In her view, the amount of instruction given at school was not good enough for students to get a high percentage in the final examinations, which was very important to get admission in a good course at university.

These children were living in a very protective atmosphere. The male children especially are not given any responsibilities at home, partly due to the fact that help can be hired at a very nominal rate. The political unrest in the city is another factor resulting in parental protection towards their children. Ravi's driving children to the

bus stop (which is very close to home) and waiting until the bus picks them up is an example of this. When asked why he was waiting, he said that any time there can be a strike and the children are in trouble. Once the children board the school bus, the school is responsible for their safety. He did not want to take any chances with the safety of children. Even on his way back from work he went to pick up Ashu from the coaching centre. Normally, he would have come back home on his own, but the bomb blast had created unrest and all the public transport had come to a halt in protest.

In the next section, descriptions of the classroom life of students, provides insights into the teacher-student interactions and science classroom-learning environment in Jammu, India. The effect of life outside classroom on the perceptions of students is further discussed in section 7.5.

7.4 LIFE IN THE CLASSROOM

The account presented in the next two stories (one from a science theory class and the other from a science practical class) take into consideration observations and interviews made over a number of occasions and aim to provide an authentic picture with which the reader can identify (Adler & Adler, 1994). Although all the aspects of the stories might not be present in any one classroom, none are uncommon in the science classrooms that were observed. The two stories ‘A Science Theory Classroom’ and ‘A Science Practical Classroom’ are followed by an interpretative commentary (Geelan, 1997).

7.4.1 Story 2. A Science Theory Classroom

Deep in thought, watching the heavy traffic on the road, I was asked by Para military personnel to keep away. I became aware of my inattentiveness. I was waiting outside a school complex,

where I had to conduct observations in a year 9 science classroom on that day. Despite the fact that I had already obtained consent from the principal of the school to come and observe a nominated classroom, I was not allowed entry into the school. My driver was asked to park the car away from the school gate because of the safety regulations. I had to fill in a prescribed form stating the purpose of the visit and whom I intended to meet in the school. This form had to be sent in through the school orderly. Till then I was asked to wait on the road outside the school. After about 20 minutes an orderly came and let me inside the school. It was a solid concrete three-story building with a playground at the back of the school. The entrance hall/foyer of the school was well furnished and there was an eye-catching nine feet by four feet poster which showed a burning candle in it and read 'TEACHER IS LIKE A CANDLE, IT BURNS ITSELF TO GIVE LIGHT TO ITS STUDENTS'.

An orderly directed me to see the principal first. She was sitting in a comfortable chair in her office and an impressive collection of trophies could be seen at the back, kept in large glass cabinet. The principal allocated a teacher to assist me who showed a lot of inquisitiveness about my study. Other staff members first were conspicuously looking at me but later, when I was introduced to them and gave me friendly smiles. On the whole, every one was curious to know what I was doing. It was the first time that they were witnessing such an activity being carried out in their institution. After the usual protocol, we headed towards the classroom, which was on the first floor. On my way to the classroom, I saw students returning quietly from a morning assembly in a neat straight queue. They were all wearing neatly-ironed school uniforms.

By the time I reached the class, which I was going to observe, the teacher had already arrived. On my entry into the class, the teacher paused and all the students got up as a mark of respect and welcomed me. I thanked them and requested them to sit down. The assistant teacher introduced me to the science teacher, who already was aware of my study. I tried not to disturb them and quietly went and sat on a chair at the back of the room. This was a well-ventilated classroom with nearly 50 students in it. The classroom was furnished with desks and benches, which were nearly two and a half feet in length and three students shared each bench and desk. Big satchels hung at the back of their benches. Two fans were fixed to the ceiling but being a cold day they were not working, but I was told that even in summer months they would face power failures/cuts from time to time. Male and female students sat on the opposite sides of the classroom. The walls of the classroom were decorated with educational charts, moral sayings and photographs of the national leaders. There was an elevated dais for the teacher, which was furnished with a chair and a table. The teacher faced the students most of the time with a black chalkboard at her back, the only permanent visual aid, which she used. From time to time, the teacher used charts or specimens, which had to be specifically issued by the school library on request. A picture of a typical classroom can be seen in Appendix G.

Although I tried not to disturb the class, students still started murmuring. I considered myself to be an intruder in the class and such condition was not only rare but also unthinkable for these students. The teacher gave a brief introduction about myself and the purpose of the visit. I could hear student hissing, "Researcher from Australia uh! Why?" There were quite a few short comments, which I could hear.

The teacher started that day's lesson and, indicated on the black board that she was going to teach 'Reflection by Spherical Mirrors'. The classroom had "pin-drop" silence but still I could hear the honking of the vehicles on the main road. The lesson started with an introduction to light, which the students must have studied in the previous year. There were quite a few questions and answers as previous knowledge of the topic was reviewed thoroughly.

The teacher started her lesson in a lively manner, and tried to include each student as she progressed in her lecture. Her eyes were wide open. The teacher then unfolded a chart showing the different positions and the nature of the images formed by a concave mirror. At the same time, the students had their textbooks opened and they were also referring to the book. While going through the lesson, the teacher also drew the figures on the black board. Most of the students were listening to her intently and watching her, although I noticed two boys at the back quietly trying to snatch a piece of paper from each other. In this event, they happened to make a disturbing sound and the teacher, in a loud voice, asked them to refrain from doing so. I observed one more girl making drawings in her notebook.

Later in the lesson, the teacher asked the students if they had any doubts about the content taught. The students raised their hands and the teacher answered each one of them one by one. While answering the queries of the students, the teacher also cross-examined them for their understanding by asking them more questions on the same topic. After this, the teacher wrote a few questions on the blackboard and the students were asked to answer them in their notebooks at home. Next day they would submit the homework to the teacher for correction. Only five minutes were left for the next class and two student representatives stood up. One started distributing the notebooks, which the teacher had corrected and brought with her, while

the other one started collecting notebooks from the students where the homework given on the previous day was done. The assistant teacher told me that these students had class tests every Monday on the topics taught in the previous week. The weekend was said to be the right time to learn and then revise. The students had to get these answer books signed by their parents. Soon the school bell rang for the next lesson and all the students got up in respect for their teacher and farewell her collectively. I also left the classroom at the same time. This account is of a typical year 9, science classroom in India.

Soon after the class teacher joined me outside in the verandah, and explained that she would encourage students to use the library but they had to find time for library study on their own; it was either during the recess period or if they had any free periods in the day (when the teacher concerned would be absent). She had assigned one science lesson a week for laboratory sessions, during which students in groups of four had the opportunity to research the topics taught. All the students were required to submit the reports of their practical separately. The teacher perceived that practical sessions were less-teacher centred compared with the theory classes.

I decided to observe a practical class in progress. The next story (Story 3) develops on the basis of observations of science practical classes in Jammu, India. The findings of the observations are developed in the form of student teacher interactions and classroom learning environments in Jammu, India and discussed later in this chapter. These findings are on the basis of common observations in a number of classes.

7.4.2 Story 3: A Science Practical Class

It was a cold but bright morning and I was scheduled to go and observe a Science Classroom. Due to the political disturbances, my work was running a little slower than scheduled and I was feeling a little low. A hot bath followed by a sumptuous breakfast (Indian hospitality) was enough to make me feel better. At about 8.45 am I left home along with my husband and driver. The three-kilometre drive to school was an experience, after a full week of forceful house arrest. Despite the fact that during the previous week, the city had been either under curfew imposed by the government or closed, due to a call given by the militant or opposition parties, that day the roads were fully jammed with all sorts of traffic on them. My driver told me that Jammu city had the second heaviest traffic density in the world. Out on the road, no one could imagine that the city had been literally paralysed for a week. Everything looked very normal and people were trying to make best use of whatever time they had for their business. This short drive simply should have taken me ten minutes but it took more than 45 minutes.

Now that I was a regular visitor to the school, I was granted entry without any hassles. I made my way towards the science laboratory. That day I was going to observe year ten students making and using a solar cooker. The physics laboratory was locked and the students were waiting for their teacher. On seeing me, they became excited and started making advances towards having a conversation with me. They all seemed to be happy and when asked the reason, all of them said in unison that they looked forward to science practical classes. One boy said that they wished that all the lessons were taught practically. According to him separating theory and practical lessons was a waste of time.

I saw the science teacher rushing towards us and as she approached I could observe students separating into two lines and standing quietly making a clear way for the teacher. She unlocked the door and students went in to the science laboratory.

Once all the students were in, I along with the science teacher entered the physics laboratory. It was a big hall, separated into four rows by two long wooden workbenches. These benches had drawers and the students sat on stools. The teacher had some sort of elevated dais with a black chalkboard as in the classroom. The lab was well lit and the teacher switched on the electric lamps that were fitted in the laboratory. I was asked to sit next to the teacher. I observed that the students were sitting in groups of four. The teacher once again started briefly explaining the lesson on making solar cookers. There were many rectangular cardboard boxes (empty fruit boxes) in one corner of the laboratory. On the teacher's command, one student from each group got up and fetched those boxes to their work area.

All the students started working on making the solar cookers. They all seemed excited. Soon all of them were painting these boxes black on the inside. I tried to keep the impact of my presence to a minimum. Aluminium foil was fixed to the lid of the box so that it could act as a reflector of light and the top of the box was covered with a glass pane. Most of the groups made these cookers without much difficulty except for one group who broke the glass pane and the teacher did not have any extra glass. When this event happened there was some tension in the class but the teacher stated to me later that because of my presence she did not make much of a fuss about it. Now that this group could not test their solar cooker, they were asked to observe another group testing their cooker.

The students came out on the verandah of the school where they placed the cookers in a line. It was nearly half past ten and I could see that the sun was up. Despite the fact it was not very hot, it was bright and according to teacher this much sunlight was enough to make solar cooker work. In the teacher's view, the bright winter season was the best time for students to experiment with such a lesson, as in summer they may not get sufficient evidence of the efficiency of solar energy. Each group of students placed a stainless steel pot with some food in it. To be specific, one group put in water for the tea and others put in curry (dal), rice for cooking and vegetables (cauliflower and potato) to be cooked. This food would take three to four hours to get ready. A school orderly was ordered to keep a vigil on the boxes in order that no one would disturb them. Soon the lesson time was over and the students went to their classroom. I, along with teacher, went to the staff room where we had a chat together and with other teachers in the school.

My curiosity about the efficiency of these innovative ordinary cookers made from locally available ordinary material did not allow me sit peacefully in the staffroom. After about an hour, I went out to examine the instruments made by students. I was thrilled to see that these cookers were heating up and steam was being produced in all the boxes. Just before the school day ended the students assembled on the verandah to test the working efficiency of their instruments. They were very curious and were thrilled to see the food , what ever they had left, ready for use. I could see the signs of victory and personal accomplishment on their faces. The pots were out and I was asked to taste the food. After I did so, all the groups shared the food and tried to get recognition from other groups. The teacher once again revised the content of the lesson by asking students questions about the basic principles and working of the solar cooker. These cookers were kept inside the laboratory and the students dispersed for home.

The classes described in the two stories above illustrate typical aspects of science classes in Jammu, India. Although the teachers tried to make use of a variety of teaching methods and activities, the lessons were predominantly teacher-centred. Even while carrying out a practical lesson, the students only carried out an activity when teacher asked them to do so. It was noteworthy that each class had nearly 50 students in it.

In both the stories, the teacher was seen to be referring to the textbook throughout the lesson. The examinations were based on the prescribed textbook, making it essential that the teacher covers all the points mentioned in the textbook thoroughly during the lesson. Keeping in view the time taken to cover each topic, the teachers were forced to stick closely to the content and this strictly dictated the depth of the content that was taught.

In both the stories, there are very few disruptions from the students and this was a common observation in most of the classes observed. There were occasions when students appeared not to be attentive (when two boys were trying to snatch a piece of paper from each other or when a girl was making drawings of the reflection) but lessons were generally taught without any interruption.

The use of charts in the theory classroom was to enhance learning. When asked whether it could have been demonstrated practically, the teacher answered that type of instruction takes longer time and proves to be a distraction for students. Theory and practical lessons are well separated and well defined at the beginning of the year only.

At the end of both the lessons, the stories are depicting a question-answer sessions in which the teacher revised the lesson. The random selection of students to answer teachers questions, gave equal probability to every student being asked the question.

The three stories have been presented to give an actual representation of the circumstances faced by students in Jammu, India. An effort has been made to depict the social, cultural, political and economical climate in the city and its possible effect on the life of students.

I used the bricolage method described by Denzin and Lincoln (1994) to draw together the information collected using a variety of research methods. The observation findings are further punctuated with short vignettes derived from field notes of my observations. The representation of the voice of the participants, has been influenced by the work of van Maanen (1988, p. 102), who explains that these tales are a means of bringing the knower and the known together as a means of “cracking open the culture and the fieldworker’s way of knowing so that both can be jointly examined...both subject and object in constant view”. One such process of elaborating and juxtaposing multiple and sometimes oppositional perspectives is through story telling (Wallace, 1998). Carter (1993) refers to many scholars within education who have recently made story a central element in their analysis of teachers’ knowledge. She further asserts that the attraction of story in contemporary research on teaching is grounded in the notion that the story represents a way of knowing and thinking that is particularly suited for explicating the issues with which we deal. Clandinin and

Connelly (1996, p. 16) define narratives as “the making of meaning through personal experience by way of a process of reflection in which story telling is a key element and in which metaphors and folk knowledge take their place”.

These interpretations were made in relation to certain themes and linked to the scales of the QTI and the WIHIC.

7.5 DISCUSSION

Denzin and Lincoln’s (1994) *bricolage* method influenced me while interpreting the information, which was collected using a variety of research methods. This approach enabled me to draw on a variety of paradigms to inform their interpretation in a bid to explain the cultural, social and political factors that could contribute towards the present teacher-student interactions and classroom learning environments.

Themes derived as a result of observations and reinforced by a variety of research methods are presented in standard text. These themes are punctuated with short vignettes to provide the reader with examples that helped me to distil these themes. The vignettes, represented in italics and separated from the main text, are derived from field notes. The voices of the participants are represented and was influenced by the work of van Maanen (1988, p. 102), who explains that tales are a means of bringing the knower and known together as a means of “cracking open the culture and the fieldworker’s way of knowing so that both can be jointly examined...both subject and object in constant view”. The main themes identified are as follows:

7.5.1 Status of Teacher

The observation results in general suggested that the teachers were enjoying a very high status from their students. Challenging the authority of the teacher was out of the question for a student. All the students getting up from their seats and welcoming or bidding farewell to the teacher when s/he enters or leaves the classroom is embedded in the culture of the place. This action is considered to be a mark of respect for the teacher.

Although it is very difficult to gauge the amount of respect students hold for their teacher, the behaviour could be the result of their upbringing with Indian traditions and values where teachers are given a very high place. Teachers in this culture do not have to face many discipline problems. Fellow students, teachers, parents, and the society generally take the slightest disobedience from students very seriously. The vignette described below from my field notes gives an insight into the state of discipline and teacher status in India.

The science teacher and I were walking towards a classroom and she was explaining to me what she was trying to accomplish as a teacher. In her words

God has entrusted these students to me and it is my duty to see that these students achieve both academically as well as morally during the time frame given to me and I may have to go all out for this.

As we approached the classroom, I could hear a lot of noise coming from the class and on our entry into the class we found two students engaged in a physical scuffle.

Suddenly there was silence in the class and the two students engaged in the fight became aware of our presence. On our enquiring, they stated that their fight was a friendly fight but the teacher ordered them to be in a “cock’s posture” outside the classroom for the whole period.

This incident gives an insight into the authority (power) of teachers in the Indian context. This sense of power in the teachers leads them to maintain a distance from the students with an acceptance of the hierarchy in the school environment. According to (Hofstede, 1983) people in large power distance societies accept a hierarchical order in which everybody has a place that needs no further justification.

In a culture like India, there is an emphasis on filial piety, giving rise to large power distances. This power distance between the students and the teacher is being recognised as respect for the teacher and giving rise to a negligible amount of discipline problems in the classroom. The disruptive behaviour of students is totally unaccepted in the schools not only by the authorities, parents and society, but even by the students. The following vignette describes perceptions about discipline and respect for teachers in school.

While interviewing the students, I asked a girl about her views on corporal punishment. To my surprise, she was in favour of it. I checked this by asking, “ Do you know that corporal punishment is officially forbidden in schools in India?” She replied:

I don't know that, but our teachers are like God to us. They impart to us the gift of knowledge and even if sometimes they beat us it is for our good.

They don't mean any harm to us and know what is best for us.

According to that student, the teacher would beat them only if they did not do well in the tests or created some disciplinary problems. Physical punishment would usually be carried out by beating the students on their hands with a stick. Parents also agreed to this behaviour exhibited by the teacher.

Minimum levels of disruptive behaviour in the classroom were still considered to be discipline issues by the school authorities. While observing the classrooms, students were seen having short whispering conversations among themselves, otherwise, by and large, the theory as well as the practical classes were mostly teacher dominated with the teacher in command. The teacher's knowledge and approach generally never were questioned.

It is possible that students generally had a very positive perception of their teachers due to cultural factors; however, the type of curriculum in the country may also have some possible effects on the learning environment in India.

7.5.2 Examination Dominated Curriculum

The curriculum on the whole is examination dominated. India's national policy on education (1968) has emphasised quality improvement and a planned, more equitable expansion of educational facilities. Some of the most widely accessible resources created by the NCERT are the books for the students and teachers. Through the writing of these books, efforts have been made to provide more activities to facilitate learning (Balasubramanian, 1998), however, during the classroom observations it was generally felt that the only immediate aim of the students was to get a good score in the examination so that they could gain admission to a desired course in the university. Although university admissions are based on year twelve results, students are fully geared towards this aim right from year nine. On the whole, the curriculum appeared to be examination driven and highly competitive. It appears that achieving high academic scores at the end of the year played a significant role for students, teachers and parents, and may be creating an obstacle in the creation of an ideal learning environment or a barrier to positive student-teacher interactions. The students, teachers and parents would view diverting from the traditional lecture method of teaching as wasting time. The following vignette describes this perception of the teacher.

It was the half-time break in the school and staff members had assembled in the staffroom. Most of them had taken out their "tiffin boxes" brought from home and ate their lunch, followed by a hot cup of tea brought in by the school table boy. I started an informal discussion in this atmosphere and began talking about the broad aims of

education and a teacher's role in this. At this time, I realised that most of the trained teachers had almost the same understanding of curriculum and the aims of education.

For example some teachers commented,

It is always nice to talk about the play method of teaching but it is nice only in books. When we were doing teacher training, our teachers also talked the same way. They never used any other method other than lectures, that is practical.

I don't mind trying other methods of teaching but, they may not be effective and my class will not obtain a good result. It is the students who suffer and the school authorities may hold it against me.

The students' goal right now is to do well in the examination and enter the university. If we start viewing education as overall development our school students are at risk, especially those who do not go to private tuition. We do use charts and take them to labs.

The culture in Jammu (India) is such that, students understand that their performance in the examination is going to decide their fate in life. The result of this is that most of the students go for private tuition. In their view the instructions given by the teacher at school are not enough, so to enhance their learning they need to take extra tuition at home. This extra guidance is believed to help them in this highly competitive environment. This aspect of the learning environment is evident in the following vignette.

On one occasion, during my data collection, I was basking in the mild winter sun which had come out after quite a few days. By now, I was a familiar person in the school and as all of them knew the purpose of my visit, they (students and teachers) all wanted to interact and share their views with me. Despite the fact that all through

their lives they had been in a co-educational school not much socialisation was obvious between the opposite genders. Soon I was joined by a group of girls who wanted to talk to me about Australian students and the reasons for Australia's excellent performance in sports. I started explaining the general life style, living conditions and emphasis given to sport and these students commented:

Hay, lucky them, once we get back home we have to rush to the tutor, otherwise we cannot do well in the examinations.

On enquiring about why they have to go for private tuitions most of the students replied in unison:

We can never be sure of completing the whole course at school especially at this time of uncertainty. There is so much political unrest and by going for extra tuition we thoroughly revise our lessons.

The examination-driven curriculum is one of the outstanding themes emerging from the observations in Jammu (India). The science curriculum is presented to students in the form of textbooks and examinations are on the content of these. As a result, it is important for students to cover all areas in the book. If teachers in school cannot do so, due to shortage of time, the private tutors definitely can do it.

Generally, the classes observed were teacher-centred with very little scope for active participation of the students. According to the teachers the type of curriculum and the political unrest in the city were the main precipitating factors of the current learning environment.

7.5.3 Effect of Political Unrest

Teachers and students in India identified political unrest/instability as one the major problems faced in creating a regular teaching atmosphere. In the views of the teachers, the political unrest was giving rise to a negative effect on the learning environment and keeping them from creating the ideal environment that they would have liked to have. This unrest was leading to added pressure being imposed by parents and teachers on students. The following vignette reflects the pressure due to the political uncertainty exerted on one of my nieces who is a year ten student:

No sooner had my niece arrived back home back from school than she was seen going through her science notes. Her mother gave her food which she could not eat properly most probably because of the stress. Next day all the traffic in the city would be closed due to some alleged killings by the security forces in Kashmir. Due to this reason, the private tutor was giving a test one day earlier and she was not ready for this. I asked my niece whether they could take the same test the day after. However before I could finish my sentence my sister intervened saying:

Oh no, how is that possible. Other teachers' students have already finished the whole course and now they are revising the important topics. You can't be sure about the number of working days you will get. Things here are very uncertain but exams are conducted on time.

Observations revealed that parents, students and teachers were not ready to take any chance that would cause them to lose time. They wanted to achieve the maximum in the minimum possible time, as they were never sure of the real working time they

would get either in school or with the private tutors. However, everyone I met longed for a more stable environment where they could work more efficiently towards a better learning environment and resulting in optimum positive growth and the best results.

7.6 CHAPTER SUMMARY

In this chapter, an effort has been made to describe my experiences and observations about the teacher-student interactions and science classroom learning environments in Jammu, India. The descriptions of family and classroom life presented in the form of narratives were intended to portray a cultural archetype so that it would be easier for the reader to relate to the context of the study. Life at home and school were identified as the two main factors leading to a set pattern of beliefs, values, expectations and norms in the society.

The main themes identified from the interviews, field notes, and observations were: status of teacher; examination-dominated curriculum and political unrest in the city. Critical reflexivity during the study enabled me to probe deeper into the overall culture created (influence of different factors), giving richer insights and understanding. It is clear that the social, cultural and political environment in Jammu, has lead me to the present perception of the learning environment which is probably the best learning environment possible at that place under present circumstances.

In the next chapter, I describe the conclusions drawn from this study and discuss its limitations. In addition, directions for future research also are explored and outlined.

CHAPTER EIGHT

CONCLUSIONS, LIMITATIONS AND FUTURE DIRECTIONS

*Then though I to understand this
But it was too hard
Psalm 73:15*

8.1 INTRODUCTION

The main aim of this thesis was to describe and analyse existing teacher-student interactions and science classroom learning environments in Jammu, India. The research explored relationships between a range of variables and factors that may affect these classrooms. Links between social, cultural and political factors were drawn in order to explain their effects on students' perceptions of teacher-student interactions and learning environments. A multiple- approach to the research resulted in the identification of factors that influence students' perceptions in a society like Jammu, India.

In this chapter first, answers are provided to the research objective outlined in Chapter 1 provides an overview of the research. Secondly, conclusions and implications from this research are made. Thirdly, the limitations of the study are acknowledged. Finally, directions for future research derived from this study and its findings are proposed.

One of the important points that I realised during the course of the study was the recognition of myself as researcher and the bias I had inadvertently brought to the study. At this point, I was able to identify the important journey that I had made as a

researcher when I returned to study in a culture where I was born and brought up after living for some time in a Western culture. I could clearly identify the changes in the cultural, social and overall political atmosphere since I had left the place. However, despite efforts to confront and overcome my bias, this may still be reflected to a certain extent in the conclusions that I make.

The conclusions in this chapter are presented under following headings:

- 8.2 Overview of the research design
- 8.3 Major findings of the study
- 8.4 Significance and implications of the study
- 8.5 Limitations of the study
- 8.6 Directions for future research
- 8.7 Summary and concluding remarks

8.2 OVERVIEW OF THE RESEARCH DESIGN

The research reported in this study is about teacher-student interaction and science classroom-learning environments in Jammu, India. The data were collected using the QTI, the WIHIC and an Attitude scale. The quantitative data generated proved to be an important base from which the study progressed. The use of interviews and observations further validated the findings from the quantitative questionnaire. The use of multiple methods confirmed my belief that any method essentially embodies a socially constructed tool with inherent potentials and limitations. It was up to me as the researcher, situated within the context of education in India, to make best use of the multi-method research potential.

The data collection began in India with the administration of the questionnaires to 1,021, students in 32 classes in Years nine and ten from seven different co-educational private schools. The schools were selected to be as true a representative of the metropolitan area of Jammu city which is the winter capital of the state of Jammu and Kashmir. Interviews followed with 64 students, two from each of the classes included

in the study. A total of 10 classes were observed for a minimum of two periods of 30 minutes each at a time when the teacher concerned was carrying out normal scheduled teaching. Both the interviews and the observations were recorded in the form of field notes and audiotapes.

Knowing the difficult, unstable and sometimes uncertain political conditions in Jammu, I had to be very cautious while carrying out the fieldwork. I had to constantly guard myself against any sort of untoward militant activity and a great deal of time, which I could have devoted to the study, was lost due to the political disturbances in Jammu. The shortage of resources in the schools, and electricity cuts, were other constraints. In these circumstances, I had to make decisions about what I could achieve realistically and practically in the field. But at the same time, the full support from principals, teachers, students, and above all parents helped me carry out the research. Students were exposed to this type of activity for the first time and wanted to spend more and more time with me which provided me with insights into their perceptions about teacher interaction and classroom learning environment in India.

8.3 MAJOR FINDINGS OF THE STUDY

The results of the study in terms of major findings are organised as responses to the research objectives listed in section 1.4

8.3.1 Research Objective 1:

To provide further validation information about the QTI (in terms of reliability, ability to differentiate between classrooms and circumplex nature) when used with an Indian sample.

The results from this study presented in Chapters 4 and 6 show that the QTI is a valid and reliable instrument for use with high school science classes in India. The validity and reliability information for the QTI when used with the Indian sample of this study are presented in Table 4.1. To determine the degree to which items in the same scale measure the same aspect of teacher-student interpersonal behaviour, a measure of

internal consistency, the Cronbach alpha reliability coefficient (Cronbach, 1951) was used. The highest alpha reliability (0.72) was obtained for the scales of Understanding and Dissatisfied and the lowest (0.50) for Student Responsibility/Freedom. The reliability results for the scales of QTI were consistently above 0.50. This suggests that the QTI can be considered a reliable tool (De Vellis, 1991) for use with Indian students. However, results obtained for the Student Responsibility/Freedom scale should be interpreted with caution as the lower alpha coefficient for this scale (0.50) may be attributed to the nature of the Indian culture. The students may be reluctant to provide frank opinions about these behaviours of their teachers.

In keeping with learning environment research tradition, the η^2 statistic was calculated to provide an indication of the degree to which each scale could differentiate between the perceptions of students in different classes. The η^2 statistic, which is the ratio of 'between' to 'total' sums of squares and represents the proportion of variance in scale scores accounted for by class membership. It was further found that each of the eight QTI scales differentiated significantly ($p < 0.001$) between classes and that the η^2 statistic, representing the proportion of variance explained by class membership, ranged from 0.13 to 0.25 for different scales. Thus, this study provides further evidence that the QTI is an internationally valid and reliable instrument with which to measure teacher-student interaction.

The construct validity for the QTI was supported by the qualitative data and the quantitative data. Those students who reported that they perceived their teacher as a good leader were in fact the same students, who scored their teachers high on the scale of Leadership in the QTI. This pattern of responses was generally consistent for all the scales of the QTI and suggests that the QTI is capable of measuring what it is intended to measure.

8.3.2 Research Objective 2:

To provide further validation about the WIHIC (in terms of reliability, factor structure, ability to differentiate between classrooms, etc.) when used with an Indian sample.

The results from the study confirm that the WIHIC also is a valid and reliable instrument for use with science students in India. In the statistical analyses the internal consistency (Cronbach alpha reliability) and discriminant validity (mean correlation of a scale with the other six scales of the instrument) were used. The results are reported in Table 4.6. The reliability coefficients for the different WIHIC scales ranged from 0.58 to 0.83. The highest alpha reliability (0.83) was obtained for the Equity scale and the lowest (0.58) for the scale Student Cohesiveness. The mean correlations of one scale with the other scales ranged from 0.38 to 0.47. These values can be regarded as small enough to suggest that each scale of the WIHIC has adequate discriminant validity, even though the scales assess slightly overlapping aspects of classroom environment.. The η^2 values ranged from 0.09 to 0.14 and were statistically significant ($p < 0.001$) for each scale. This indicates that each scale of the WIHIC is capable of differentiating significantly between classes. Overall the reliability, discriminant validity and ANOVA results confirm that the WIHIC can be used with confidence in further research in India.

The validity of the WIHIC was further supported by the construct validation of the instrument for use with the Indian sample. The high mean scores for all the scales of the WIHIC conveys a very positive picture of a classroom environment in India and this was further validated by the students' comments during interviews. The highest mean score was for the scale of Student Cohesiveness (4.77) and it was noteworthy that all of the students interviewed not one student gave negative remarks about this aspect of the classroom environment. The scales of Involvement and Investigation, both had a mean of 3.89 and this was also reflected in the interview comments of the students. Generally, most of the students perceived these classroom aspects positively.

These comments reflected the mean scores for the WIHIC and thus support the construct validity of the instrument.

8.3.3 Research Objective 3.

To compare the Indian scores of Alpha Reliability Coefficients and ANOVA on the QTI and the WIHIC with the same from previous studies in other countries.

The results of the present study reflected that, although the QTI has been demonstrated to be a valid and reliable instrument for use in India, still its alpha reliability coefficient and η^2 are consistently lower when compared with those values from Western countries as can be seen in Tables 4.2 and 4.3. The lower scores could be attributed to a culture where students are reluctant to provide a free view or these students were exposed to this type of study for the first time in their lives and were not sure about the way to respond.

A similar pattern occurs when alpha reliability coefficients of the WIHIC in India are compared with those from other countries. However, at the same time they are consistently greater than 0.50 confirming that the WIHIC can be used with confidence in India.

8.3.4 Research Objective 4.

To investigate associations between Indian students' perceptions of teacher-student interactions and attitude to science.

This study found that there were seven out of eight significant associations between teacher-student interactions and student attitude to science class. These associations were positive for the scales of Leadership, Helping/Friendly, Understanding and Student Responsibility/Freedom with attitude to class. The scales of Uncertain, Dissatisfied and Admonishing displayed significant negative associations for attitude to science. The Strict scale was not associated with attitude to class. The proportion of

variance (R^2) in attitude to science class that can be attributed to students' perception of teacher-student interaction was 15%. The standardized regression coefficient (β) found that, when the relationships between the scales was controlled only the scales of Leadership and Helping/Friendly retained their positive and significant associations with attitude to science classes.

8.3.5 Research Objective 5:

To investigate associations between students' perceptions of learning environments in India and attitudes to science.

The result of this study has demonstrated, that attitudes of students towards their science classes to be having statistically positive association ($p < 0.01$) with all the seven scales of the WIHIC. The scale of Student Cohesiveness had the lowest (0.17) and Task Orientation (0.38) highest association for attitude to science classes. The multiple correlation (R) was statistically significant (0.43) and demonstrating that nature of classroom environment was strongly influencing students' attitudes. The proportion of variance (R^2) in student perception of the classroom- learning environment was 19%. Standard regression coefficients (β) revealed that only three scales out of seven namely Investigation, Task Orientation and Equity were independent predictors of individual students' attitude towards their science classes.

8.3.6 Research Objective 6:

To investigate associations between teacher-student interactions and cognitive achievement.

The simple correlation (r) and standardised weight (β) were computed between cognitive achievements and each individuals QTI score when all other QTI dimensions are controlled.

Four out of eight scales had statistically significant relationships ($p < 0.05$) 0.09, and ($p < 0.01$) 0.2 for the simple correlation (r). Only one scale namely Understanding had statistically positive associations with student cognitive achievement. The scales of

Uncertain, Dissatisfied and Admonishing displayed significant negative associations. Cognitive achievement was higher where teachers demonstrated more understanding behaviours and less dissatisfied and admonishing behaviours.

An examination of beta weights reveals that three of the eight scales retained their significance. The Understanding and Student Responsibility/Freedom scales were positively associated, whereas the Dissatisfied scale was negatively associated with the cognitive achievement of the students. The R^2 figure suggests that 5% of the variance in student cognitive achievement can be attributed to teacher-student interpersonal behaviour.

8.3.7 Research Objective 7:

To investigate associations between students' perceptions of their classroom learning environments and their cognitive achievement.

The simple correlation (r) and the standardised regression weight (β) between cognitive achievement and each individual WIHIC scale when all other WIHIC dimensions are controlled were computed. Statistically significant associations were found with cognitive achievement and the scales of the WIHIC.

The simple correlation (r) figures indicated that there were five significant relationships ($p < 0.05$ or $p < 0.01$), out of seven scales of the WIHIC. All the associations are positive, for Student Cohesiveness, Involvement, Task Orientation, Cooperation and Equity. The simple correlation for the scales of the WIHIC varies from 0.05 for the scale of Student Cohesiveness and Cooperation to 0.14 for the scale of Task Orientation. Cognitive achievement was higher where the classroom-learning environment was promoting cohesiveness, involvement, task orientation, cooperation and equity.

An examination of the beta weights revealed four out of seven significant relationships. Involvement, Task Orientation and Equity scales had positive

relationships, whereas the Cooperation scale had a negative relationship with the cognitive achievement of the students. The R^2 figure in Table 5.10 suggests that 4% of the variance in student cognitive achievement is attributed to students' perceptions of their classroom learning environment.

8.3.8 Research Objective 8:

To investigate if there are any differences between different gender, cultural and religious groups of students and their perceptions of teacher-student interactions and classroom learning environment.

Gender Differences:

The associations between the students' perceptions of teacher interpersonal behaviour and the gender of the students were analysed. In the data analysis, male and female students' mean scores for each class were computed, and significance of gender differences in students' perceptions of teacher interpersonal behaviour and science classroom were analysed using an independent t-test. Out of eight scales of the QTI, the gender differences in the perceptions of males and females on seven scales were found to be statistically significantly different. According to the results, female students perceived more positively the leadership displayed by their teachers and the helping friendly and understanding behaviours of their teachers. On the other hand, male students perceived that their teachers displayed more uncertain, admonishing and dissatisfied behaviours and gave more student responsibility.

Gender differences with the WIHIC were also investigated in a similar manner as for the QTI. Scale item means for each gender group, mean differences, standard deviations and t-values were computed. Out of seven scales, four scales were found to have significant differences in male and female student perceptions. These scales are Student Cohesiveness, Investigation, Cooperation and Equity. Female students perceived student cohesiveness more positively, showing their regard for their fellow students, helping and getting help whenever needed. It was also found that female students perceived task orientation more favourably than their male counterparts.

These female students perceived that it is important to complete planned activities and stay on the subject matter more than did the male students who participated in the survey. As for the Cooperation scale, female students perceived that more cooperation existed among the students. For the equity scale again female students perceived that their teachers gave equal attention to both genders. From these analyses, it is apparent that female students perceived their learning environment more favourably than did male students, particularly in terms of student cohesiveness, task orientation, co-operation and equity.

Cultural Differences:

Associations between teacher-student interactions and classroom learning environment and students cultural group were examined. Culture of the students was determined by the question 'language spoken at home'. Jammu city is understood to be a melting pot of various cultures, keeping in view the migration from neighbouring provinces into this city due to various political reasons in the past five to six decades. It was amazing to know that students covered in this study, who underwent the same core curriculum at school, came from 13 different cultural subgroups. A total of 918 students in the study for investigation were included from Hindi, Kashmiri, Dogri and Punjabi speaking, and are a clear indication of students' cultural backgrounds.

To examine the cultural differences in students' perceptions of the teacher-student interactions and classroom learning environments in the science classes, the within-class cultural subgroup mean was chosen as the unit of analysis which aims to eliminate the effect of class differences due to the strength of various groups being unevenly distributed in the sample.

In the data analysis, mean scores for each of the 13 cultural groups were computed. Differences in the perceptions of students about their science teachers on six of the eight scales of the QTI were statistically significant. The scales, in which there were significant differences in students' perceptions of student teacher interactions, were Helping/Friendly, Understanding, Uncertain, Dissatisfied, Admonishing and Strict.

The Tukey's post hoc test ($p < 0.05$) revealed that for the Helping/Friendly scale the Kashmiri group of students were dominant and had statistically significant higher means while as the Dogri group of students had the lowest means for the scale of Understanding and higher means for the scales of Admonishing, Dissatisfied and Strict.

On the other hand, statistical analysis confirmed student perceptions on four scales out of seven of the WIHIC had statistically significant differences. These scales were Student Cohesiveness, Task Orientation, Cooperation and Equity. The Tukey's post hoc test ($p < 0.05$) revealed that, students coming from the Kashmiri group had significantly higher means for Student Cohesiveness, Task Orientation, Cooperation and Equity scales. The Dogri group of students perceived less involvement and investigation in their classroom environment than the other three groups involved in the study.

Religious Differences:

Next, associations between teacher-student interactions and classroom learning environment and the type of religious faith of the students were examined. The students in this present study came from five different religious faiths, namely, Hindu, Sikh, Muslim, Christian, and Jain.

Statistical analyses established that there were no associations between the perceptions of the students and their religious faith. Not even a single scale of the QTI or WIHIC shows a statistically significant difference.

8.3.9 Research Objective 9:

To conduct observations and in-depth interviews with students in order to explain the associations between student's attitudes and achievements, and how cultural factors affect student outcomes.

To answer this research objective, I conducted in-depth interviews with students and observations in the classrooms in order to explain the associations between student's attitudes and achievements, and how cultural factors affect student outcomes.

In order to know more and understand the existing learning environment in India, I had to capture the perspectives of the participants and examine the culture and constraints present. At this point, qualitative data were included in the study to support or to make sense of the quantitative analysis. It was felt that the quantitative data told only part of the story. Student interviews were primarily used to further validate the QTI, the WIHIC and the Attitude scale. The observations were to be interpreted and this move towards interpretative approach (Erickson, 1998) was a natural progression. As a result of an examination of the qualitative data, I distilled themes that I felt were most likely to influence the teacher-student interaction and classroom-learning environment in Jammu, India. Observations were interpreted in the form of stories to enable me to identify these themes.

The main themes identified are as follows:

- It appears that teachers in India enjoy a very high status in the eyes of the students. The culture in the place has no scope for challenging the authority of the teacher. Consequently, they do not generally face any discipline problems while teaching. Students used the metaphor of 'Maker' or even 'God' during interviews about the teacher.
- The highly competitive curriculum requires science teachers to devote most of their time to teaching the content required, for students to do well in their examinations which decide their eligibility for a said course in the university and indirectly deciding their social standing.

- Students are generally seen to be putting in a lot of effort to achieve good results in examinations. But even then this was not necessarily a fool-proof way. Not all students would get into the courses they would have liked.
- In addition to regular school, most of the students were having extra private tuition, especially in science, at home to improve their performance in the final examination. So, the cognitive achievement of the students is not only due to the instruction received at the school, but to a combination of both, instruction at school and home.
- The disturbed political scenario of the city was putting undue pressure on students. Most of the time they were concerned about what was happening in the city and if they could get back home safely.
- Finally, the expectations of the family and the student's home life would appear to have an influence on their attitude towards teacher, science and school. In general, students are expected and encouraged to study hard and attend a good course at the university. The cultural and social factors appear to have a powerful influence on the creation and shaping of teacher-student interactions and classroom learning-environment in Jammu, India.

8.4 SIGNIFICANCE AND IMPLICATIONS OF THE STUDY

This section contains a discussion on the implications that the research findings could have on teacher-student interaction and science classroom learning-environment in Jammu, India. A distinctive part of this research was the use of vignettes that provided rich descriptions of classrooms and life in Jammu, India and explored social, cultural and political factors affecting the lives of students and teachers. The synthesis of qualitative and quantitative findings was designed to provide deeper understandings.

The study is significant because the outcomes can provide guidelines, based on information provided by a person who has no involvement in Indian society, for policy makers and teachers to improve science in India. The study also has two levels

of significance; the first is for myself as a researcher and an educator who has worked and carried out this investigation in a politically-disturbed city and second for the teachers and policy makers in Jammu, India.

8.4.1 Significance from a Personal Perspective

From a personal perspective, this study has enabled me to visit a sample of schools and science classrooms in a politically disturbed city and this has given me new insights into the lives of the teachers there. I could identify the differences between the science classroom cultures there today and those that existed when I was a part of that society a few years ago. Through watching science teachers in science classrooms and talking to teachers, it was possible for me to recognise and document the factors responsible for creating existing teacher-student interaction and science classroom-learning environment in Jammu, India. The issues, constraints and challenges that arose as part of the study will enable me to better understand the complex role play of the factors in my role as an educator studying learning environments.

8.4.2 Significance for Researchers, Teachers and Policy Makers

Of great significance from this study is that for the first time the QTI and the WIHIC were used with an Indian sample thus providing validation data for both the instruments. Studies that follow can use these questionnaires with confidence and have a large set of data with which to make comparisons. The obtained means of the QTI and the WIHIC with that from previous studies in other countries has also given a clear view of the perceptions of Indian students in comparison with the perceptions of students from other countries.

Investigating the associations between the attitudes of students and their teacher-student interactions and classroom learning environments has made it possible to suggest that if teachers wish to improve the achievement and attitudes of their students

then they should ensure that those behaviours that have been found to be empirically linked to these variables should be present in their classes. Another key result of this study is to provide teachers with a practical means by which they can monitor and evaluate their science classrooms teaching learning to better serve their students. This is very important in the Indian culture where the education is very competitive and schools are striving for high performance. The direct implications of associations between attitude and achievement become important factors for any school wishing to improve or maintain its performance.

It was amazing to find that in the small city of Jammu, there were student coming from thirteen different cultural backgrounds. The students' cultural background has shown to be an influence on how students perceive the learning environment. Teachers with a class of students of different cultural backgrounds should not interact with students as a homogeneous group but take these factors into account. It is also clear that more regular feedback from students would help teachers and policy makers understand better how students perceive those traits in teachers or classes that have been shown to be linked to achievement and attitude to science. Teachers who are aware of gender differences and cultural background factors of their students reduce the uncertainty and risks of providing situations that are detrimental to students of particular sex or cultural background groups.

An interesting finding of the study is that type of religion has no impact on the perceptions of students in science education. It is generally accepted that the problem in Jammu and Kashmir is a religious one but, on the contrary, students coming from different religious faiths in the same class have shown no difference in their perceptions of teacher-student interactions and classroom-learning environment. This is the first time such a research finding has been found in the state of Jammu and Kashmir.

The present study contributed further by synthesising the use of quantitative and qualitative data (Tobin & Fraser, 1998) providing deeper understandings. The use of

narratives and vignettes was employed, to provide rich descriptions of the social, cultural and political environment in Jammu, India. The interview data were found to support the construct validity of the QTI and the WIHIC and were consistent with the findings of the quantitative data. Based on this association between two methods of data collection and their positive association, teachers or policy makers may choose to use discussions with students as a primary and easy tool of reflection on their teaching.

8.5 LIMITATIONS OF THE STUDY

Although many of the findings of this research can relate to similar situations being studied in other parts of India, caution must be taken in generalising the results because of the limitations of the study. The limitations relate to the insider-outsider dichotomy, the limited time frame, political instability, the presence of the researcher, and the instruments used.

8.5.1 The Insider-Outsider Dichotomy

Despite the fact that I was born and brought up in the place where the research data was collected, I came into the place from, not only outside the city or state, but a different country. This factor brought a blend of insider-outsider eyes to the study. The idea in this was to link the vastly different existing worlds of the researcher, the reader, the teachers and students in a compassionate drama of empathy, understanding, caring and responsiveness. I had also to take into consideration the vast changes that had occurred in the social and political systems of the city since I left the country. I tried to achieve this link from the perspective of a person who was born, brought up and worked there in the past., however, it is acknowledged that to some extent I was an outsider and this may have influenced my observations.

8.5.2 A Limited Time Frame

In all, I spent ten weeks in Jammu, India and collected all the quantitative as well as qualitative data in this one single time period. Due to economic and practical constraints, I was unable to travel to India several times. Thus, I only had a limited amount of time for administering of questionnaires, conducting interviews and observing classrooms. I would have liked to observe the classrooms more often and delve deeper into the different aspects of student-teacher interaction and science classroom learning environment in Jammu. However, time did not permit this.

8.5.3 The Political Instability

The political instability of the place proved to be one of the major limitations of the study. The unstable political scenario was constantly disturbing the school working, with a result of leaving less time for the study. Most of the time when I would be out collecting data, safety was a big concern and it did impact on the study.

8.5.4 Presence of the Researcher

The influence of the researcher on teacher-student interaction and classroom learning environment cannot be ignored in studies where classroom observations are involved. As I always made prior appointments for my visits, my presence may have caused the teachers to be better prepared, to be careful in their content use and in their pedagogical approach, and in their behaviour patterns. I also brought to classroom observations my experiences as a researcher and educator. For this study, non-participant observation methods were chosen, so that I could recognise and minimise some of these limitations and “the tension between the complexity of the research environment and the personal and professional understanding of the individuals within it” (Schatz, 1993, p.3)

8.5.5 Instruments used

Given the practical constraints of the limited time frame, I was unable to pilot test and validate my questionnaire with the actual sample. I instead pilot tested all the three instruments, namely, the QTI, the WIHIC and the Attitude Scale, on children who had recently migrated from India to Australia. This may have had implications for meanings of certain words in the questionnaire. Although the statistical analysis indicated that the instruments used were valid and reliable, in order for the instruments to be used in advanced statistical analysis, the instrument should be used with even larger samples of students and teachers to achieve higher reliability and validity (Coakes & Steed, 1999).

8.5.6 Inclusion of Varied Data

Keeping in view the limited time frame and the political instability it was not possible for me to include government and rural schools in the study. I would have personally liked to investigate both of these subsets. From a security point of view, I was advised not to go into the rural areas. Also, as one of my research objectives was to investigate the differences in perceptions of different genders in the same class, I decided not to include government schools in my study. The government high schools in Jammu, were found to be single sex schools. However care was taken to include the schools where students were coming from a varied section of the society and thus making the sample as representative as possible.

8.6 DIRECTIONS FOR FUTURE RESEARCH

As I approach the end of my research journey, I can clearly see the end of the tunnel I was passing through, but at the same time I see a start of the larger tunnel. I see my research as a pilot study and I am at the beginning of new directions, projects, and possibilities. Some suggestions for future research are indicated in the following sections:

8.6.1 Replication of the Study

The complex nature of social, cultural and social factors affecting the student-teacher interaction and science classroom learning environment are not confined to students in Jammu, India, but include many other societies in every continent that have massive political upheavals and where a vast majority of the population has been socio-economically affected. This research study could be replicated in other politically disturbed societies to contribute to the understanding of related problems in the field of learning environments taking into consideration the insights and learning that have taken place during this study.

The same study could be replicated in government schools and rural schools in Jammu and Kashmir, and other parts of India. India has a vast population and it is presumed that different sub groups may have differing perceptions based on their experiences and culture.

8.6.2 Parallels of the Study

The possibilities for continuing research based on what this study has discovered in science education prompts questions about what may be happening in other areas of education. For example, are there parallels in mathematics education and the technology education? Can we make associations between the physical learning environment and psychological learning environment?

Parallels of the study could be carried out to investigate differences in perceptions of primary, middle and upper school students' perceptions on student-teacher interactions and classroom learning environment. The study at lower school may allow a longitudinal study where students' perceptions can be followed through his/her school career. This way the long-term effects of school environment on students' perceptions of life-long learning and their willingness to go in for higher education can be investigated.

8.6.3 Teachers, principals, parents and policymakers in the Study

The present study opens the way for a wealth of studies that explore the perceptions of teachers of their interaction with the student and the learning environment created. Learning environment research is almost completely unexplored in India with an exception of this present study. Thus validating and modifying the other versions, for example the preferred forms or teacher forms, of the QTI and the WIHIC, will enhance the potential usefulness of the instruments, thus giving an insight into the learning environments of the students, teachers, parents and the policy makers.

8.6.4 Comparative Study

More studies need to be undertaken where the comparisons between social, cultural, political and economic factors of varying degrees are studied and their effects on the learning environment. This could occur between the various factors and different populations, either within an Indian context or an Asian context or even at an international level. This research could be a comparative study between Indian and Australian students' perceptions giving similarities and differences in perceptions and expectations of students. This could help in understanding the nature of the vast number of students coming to Australian universities every year from India to pursue their higher education.

8.6.5 Narratives in the Study

The use of narratives in educational research needs to be explored fully. There is a great deal of potential for the use of stories to identify the biases and assumptions of the researcher. Although stories have been used in this study, their use in identifying the perceptions of participants of learning environments in India or other parts of the world could be pursued further in future studies.

The prospects for future research in learning environment are seemingly endless and I view this study making a platform from which more studies can begin.

8.7 SUMMARY AND CONCLUDING REMARKS

This thesis provides the first ever account of a study using learning environment instruments in India. Teacher-student interaction and science classroom learning environments were successfully investigated using a multiple method approach. Associations between students' attitudes and their perceptions of teacher-student interaction and classroom environment were investigated. Links between gender, social, cultural, political and economic factors on education and their effects on attitude and cognitive achievement of the students were analysed. As a result it provided the first large scale validation data for the QTI, the WIHIC and the Attitude Scale with an Indian sample. These validation data were construct validated with the interview data.

The results from this study can provide guidelines for teachers in India who wish to develop more positive and productive learning environments for their students. Ultimately, it is the Indians who must decide the type of learning environment they want to have and implement accordingly. The same findings can be used in a broader perspective applied to learning environments in areas other than science. This study, although the first in India, has added to the existing rich and maturing learning environment research at the global level.

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APPENDICIES

Appendix A

Position of Jammu and Kashmir Within India

“Map removed for copyright reasons”.

Appendix B
Number and Classification of Schools in Jammu
Province.

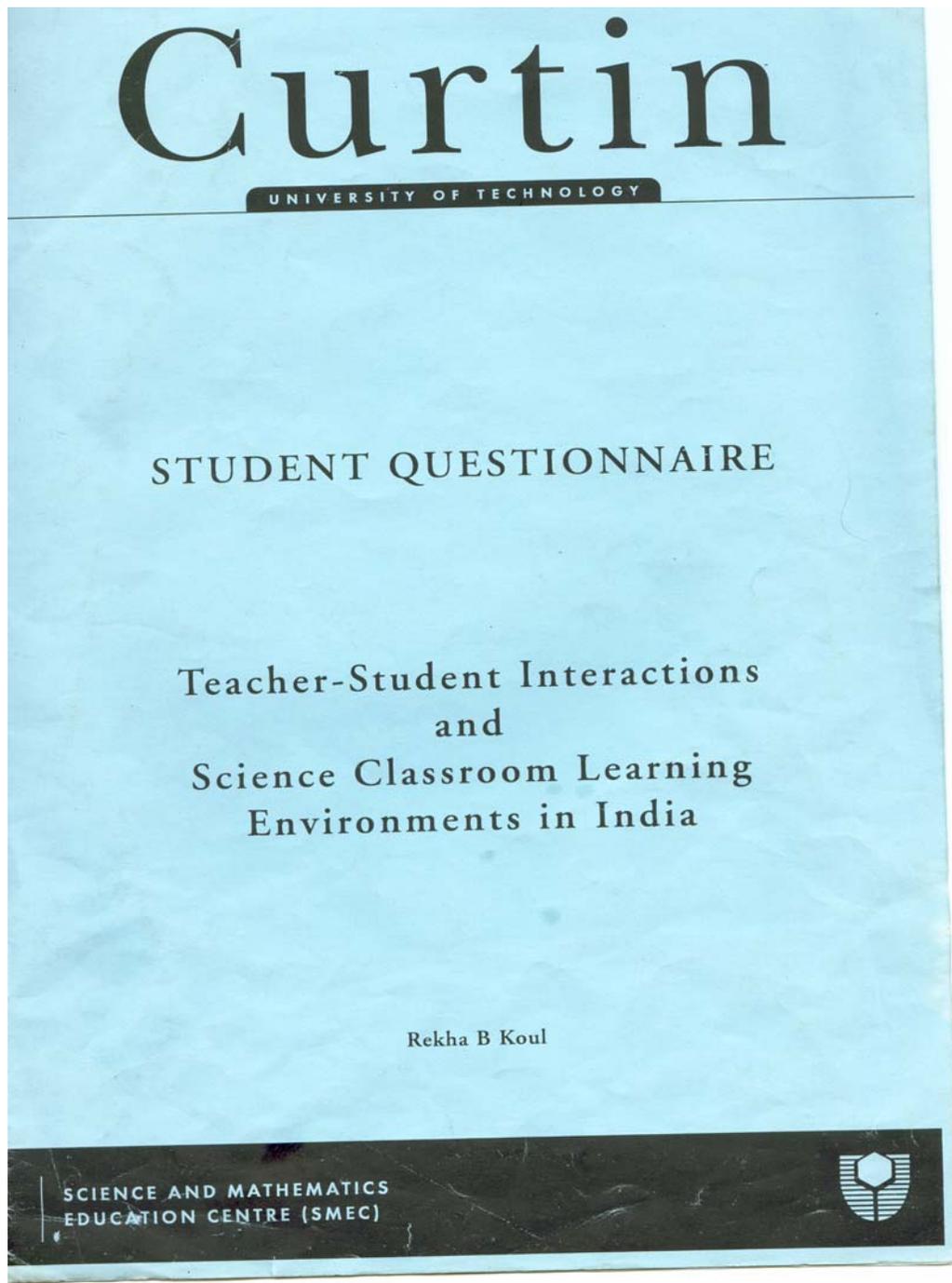
Type of School	No. Of Schools
Government	13017
Private	12826
Aided	399
Unaided	2072

Total No. Of High Schools In the State of Jammu and Kashmir.

Rural	63,289
Urban	8,704
Total	71,993

Source: Government Secretariat, Department of Education, J&K State.

Appendix C
Questionnaire



Directions for Students

These questionnaires contain 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.

Practice Example

Suppose you were given the statement "I choose my partners for group discussion." You would need to decide whether you choose your partners 'Almost always', 'Often', 'Sometimes', 'Seldom' or 'Almost never'. If you selected 'Often' then you would circle the number 4 on your questionnaire.

Your Name: _____

Teacher's Name: _____

School: _____

Language Spoken at Home: _____

Religion: _____

Grade: _____

Gender: Male Female

What Is Happening in this Class

SC	Almost Never	Seldo m	Some- times	Often	Almost Always
1. I make friendships among students in this class.	1	2	3	4	5
2. I know other students in this class.	1	2	3	4	5
3. I am friendly to members of this class.	1	2	3	4	5
4. Members of the class are my friends.	1	2	3	4	5
5. I work well with other class members.	1	2	3	4	5
6. I help other class members who are having trouble with their work.	1	2	3	4	5
7. Students in this class like me.	1	2	3	4	5
8. In this class, I get help from other students.	1	2	3	4	5
TS	Almost Never	Seldom	Some- times	Often	Almost Always
9. The teacher takes a personal interest in me.	1	2	3	4	5
10. The teacher goes out of his/her way to help me.	1	2	3	4	5
11. The teacher considers my feelings.	1	2	3	4	5
12. The teacher helps me when I have trouble with the work.	1	2	3	4	5
13. The teacher talks with me.	1	2	3	4	5
14. The teacher is interested in my problems.	1	2	3	4	5
15. The teacher moves about the class to talk with me.	1	2	3	4	5
16. The teacher's questions help me to understand.	1	2	3	4	5
IN	Almost Never	Seldom	Some- times	Often	Almost Always
17. I discuss ideas in class.	1	2	3	4	5
18. I give my opinions during class discussions.	1	2	3	4	5
19. The teacher asks me questions.	1	2	3	4	5
20. My ideas and suggestions are used during classroom discussions.	1	2	3	4	5
21. I ask the teacher questions.	1	2	3	4	5
22. I explain my ideas to other students.	1	2	3	4	5
23. Students discuss with me how to go about solving problems.	1	2	3	4	5
24. I am asked to explain how I solve problems.	1	2	3	4	5
IV	Almost Never	Seldom	Some- times	Often	Almost Always
25. I carry out investigations to test my ideas.	1	2	3	4	5
26. I am asked to think about the evidence for statements.	1	2	3	4	5
27. I carry out investigations to answer questions coming from discussions.	1	2	3	4	5
28. I explain the meaning of statements, diagrams and graphs.	1	2	3	4	5
29. I carry out investigations to answer questions which puzzle me.	1	2	3	4	5
30. I carry out investigations to answer the teacher's questions.	1	2	3	4	5
31. I find out answers to questions by doing investigations.	1	2	3	4	5
32. I solve problems by using information obtained from my own investigations.	1	2	3	4	5

TO	Almost Never	Seldo m	Some- times	Often	Almost Always
33. Getting a certain amount of work done is important to me.	1	2	3	4	5
34. I do as much as I set out to do.	1	2	3	4	5
35. I know the goals for this class.	1	2	3	4	5
36. I am ready to start this class on time.	1	2	3	4	5
37. I know what I am trying to accomplish in this class.	1	2	3	4	5
38. I pay attention during this class.	1	2	3	4	5
39. I try to understand the work in this class.	1	2	3	4	5
40. I know how much work I have to do.	1	2	3	4	5
CO	Almost Never	Seldo m	Some- times	Often	Almost Always
41. I cooperate with other students when doing assignment work.	1	2	3	4	5
42. I share my books and resources with other students when doing assignments.	1	2	3	4	5
43. When I work in groups in this class, there is teamwork.	1	2	3	4	5
44. I work with other students on projects in this class.	1	2	3	4	5
45. I learn from other students in this class.	1	2	3	4	5
46. I work with other students in this class.	1	2	3	4	5
47. I cooperate with other students on class activities.	1	2	3	4	5
48. Students work with me to achieve class goals.	1	2	3	4	5
E	Almost Never	Seldo m	Some- times	Often	Almost Always
49. The teacher gives as much attention to my questions as to other students' questions.	1	2	3	4	5
50. I get the same amount of help from the teacher as do other students.	1	2	3	4	5
51. I have the same amount of say in this class as other students.	1	2	3	4	5
52. I am treated the same as other students in this class.	1	2	3	4	5
53. I receive the same encouragement from the teacher as other students do.	1	2	3	4	5
54. I get the same opportunity to contribute to class discussions as other students.	1	2	3	4	5
55. My work receives as much praise as other students' work.	1	2	3	4	5
56. I get the same opportunity to answer questions as other students.	1	2	3	4	5
AS	Almost Never	Seldo m	Some- times	Often	Almost Always
57. I look forward to science lessons.	1	2	3	4	5
58. Science lessons are fun.	1	2	3	4	5
59. I dislike science lessons.	1	2	3	4	5
60. Science lessons bore me.	1	2	3	4	5
61. Science is one of the most interesting school subjects.	1	2	3	4	5
62. I enjoy science lessons.	1	2	3	4	5
63. Science lessons are a waste of time.	1	2	3	4	5
64. Science lessons make me interested in science.	1	2	3	4	5

Questionnaire on Teacher Interaction

QTI		Almos t never	Seldo m	Some- times	Often	Almost Always
1.	This teacher talks enthusiastically about his/ her subject.	1	2	3	4	5
2.	This teacher trusts us.	1	2	3	4	5
3.	This teacher seems uncertain.	1	2	3	4	5
4.	This teacher gets angry unexpectedly.	1	2	3	4	5
5.	This teacher explains things clearly.	1	2	3	4	5
6.	If we don't agree with this teacher, we can talk about it.	1	2	3	4	5
7.	This teacher is hesitant.	1	2	3	4	5
8.	This teacher gets angry quickly.	1	2	3	4	5
9.	This teacher holds our attention.	1	2	3	4	5
10.	This teacher is willing to explain things again.	1	2	3	4	5
11.	This teacher acts as if he/she does not know what to do.	1	2	3	4	5
12.	This teacher is too quick to correct us when we break a rule.	1	2	3	4	5
13.	This teacher knows everything that goes on in the classroom.	1	2	3	4	5
14.	If we have something to say, this teacher will listen.	1	2	3	4	5
15.	This teacher lets us take charge.	1	2	3	4	5
16.	This teacher is impatient.	1	2	3	4	5
17.	This teacher is a good leader.	1	2	3	4	5
18.	This teacher realises when we don't understand.	1	2	3	4	5
19.	This teacher is not sure what to do when we fool around.	1	2	3	4	5
20.	It is easy to pick a fight with this teacher.	1	2	3	4	5
21.	This teacher acts confidently.	1	2	3	4	5
22.	This teacher is patient.	1	2	3	4	5
23.	It is easy to make this teacher appear unsure.	1	2	3	4	5
24.	This teacher makes mocking remarks.	1	2	3	4	5
25.	This teacher helps us with our work.	1	2	3	4	5
26.	We can decide some thins in this teacher's class.	1	2	3	4	5
27.	This teacher thinks that we cheat.	1	2	3	4	5
28.	This teacher is strict.	1	2	3	4	5
29.	This teacher is friendly.	1	2	3	4	5
30.	We can influence this teacher.	1	2	3	4	5
31.	This teacher thinks that we don't know anything.	1	2	3	4	5
32.	We have to be silent in this teacher's class.	1	2	3	4	5
33.	This teacher is someone we can depend on.	1	2	3	4	5
34.	This teacher lets us decide when we will do the work in class.	1	2	3	4	5
35.	This teacher puts us down.	1	2	3	4	5
36.	This teacher's tests are hard.	1	2	3	4	5
37.	This teacher has a sense of humour.	1	2	3	4	5
38.	This teacher lets us get away with a lot in class.	1	2	3	4	5
39.	This teacher thinks that we can't do things well.	1	2	3	4	5
40.	This teacher's standards are very high.	1	2	3	4	5

		Almost never	Seldo m	Some- times	Ofte n	Almost Always
41.	This teacher can take a joke.	1	2	3	4	5
42.	This teacher gives us a lot of free time in class.	1	2	3	4	5
43.	This teacher seems dissatisfied.	1	2	3	4	5
44.	This teacher is severe when marking papers.	1	2	3	4	5
45	This teacher's class is pleasant.	1	2	3	4	5
46	This teacher is lenient.	1	2	3	4	5
.						
47	This teacher is suspicious.	1	2	3	4	5
.						
48	We are afraid of this teacher.	1	2	3	4	5
.						

Appendix D

Letter of Consent Sent To Principles

Rekha B Koul
Science and Mathematics Education Centre
Curtin University of Technology
Perth WA, Australia
Phone: +61 8 92662989
Fax: +61 8 9266 2503
e-mail: rekhakoul@hotmail.com

Dated: 15th oct. 2000

Dear Principle,

I Rekha B Koul under the supervision of Prof. Darrell Fisher from the National Key Centre for Science and Mathematics Education centre, Curtin University of Technology, Perth Australia, am conducting a study to examine the ‘Teacher-Student Interactions and Science Classroom Learning Environments in Jammu, India’.

This study is unique in that for the first time such an enquiry is being made with students of Jammu. The results of this study will give school authorities and teachers an insight into their own teaching and the existing learning environment. It is anticipated that over a 1000 students from different private co-educational schools in your city will participate in this study.

The study would involve year 9 and 10 students answering a questionnaire, which would take about 20 minutes to complete. I shall also be observing few classes when they are in progress and interviewing some students at a later date convenient to you.

The anonymity of your school, teachers And students will be preserved throughout as identification numbers will be used for all the data analyses. All data collected will be treated as confidential and any published results will not reveal individual student or teacher names.

I shall be visiting India In first week of February, 2001 and intend to stay there for couple of months for the purpose of data collection. If you agree students of your school to participate in this study please intimate me as soon as possible. A reply paid envelope has been provided.

A certificate of participation will be given to your school from the Curtin University of Technology.

Yours Sincerely
Rekha B Koul

Appendix E

Items of the Questionnaire Selected as a basis for Interview

WIHIC

Student Cohesiveness

- 2. I know other students in this class.
- 6. I help other class members who are having trouble with their work.
- 8. In this class, I get help from other students.

Teacher Support

- 9. Teacher takes personal interest in me.
- 10. The teacher goes out of his/her way to help me.
- 15. The teacher moves about the class to talk with me.

Involvement

- 17. I discuss ideas in class.
- 19. The teacher asks me questions.
- 24. I am asked to explain how I solve problems.

Investigation

- 25. I carry out investigations to test my ideas.
- 29. I carry out investigations to answer questions which puzzle me.
- 31. I find out answers to questions by doing investigations.

Task Orientation

- 34. I do as much as I set out to do.
- 35. I know the goals for this class.
- 37. I know what I am trying to accomplish in this class.

Cooperation

- 41. I cooperate with other students when doing assignments.
- 46. I work with other students in this class.
- 48. Students work with me to achieve class goals.

Equity

- 52. I am treated the same as other students in this class.
- 53. I receive the same encouragement from the teacher as other students do.
- 55. My work receives as much praise as other students' work.

Attitude Scale

- 58. Science lessons are fun.
- 60. Science lessons bore me.
- 61. Science is one of the most interesting school subjects.
- 63. Science lessons are a waste of time.

QTI

Leadership

- 5. This teacher explains things clearly.
- 9. This teacher holds our attention.

Understanding

- 2. This teacher trusts us.
- 14. If we have something to say, this teacher will listen.

Uncertain

- 15. This teacher lets us take charge.
- 23. It is easy to make this teacher appear unsure.

Admonishing

- 4. This teacher gets angry unexpectedly.
- 24. This teacher makes mocking remarks.

Helping Friendly

- 29. This teacher is some one we can depend on.
- 37. This teacher has a sense of humour.

Student Responsibility

- 34. This teacher lets us decide when we will do the work in class.
- 42. This teacher gives us a lot of free time in class.

Dissatisfied

- 31. This teacher thinks we cheat.
- 43. This teacher seems dissatisfied.

Strict

- 32. We have to be silent in this teachers' class.
- This teacher's standards are very high.

Appendix F
Certificate of Participation

Curtin

UNIVERSITY OF TECHNOLOGY

SCIENCE AND MATHEMATICS EDUCATION CENTRE

CERTIFICATE
OF PARTICIPATION

THANKFULLY PRESENTED TO

FOR THEIR KIND CO-OPERATION
IN THE STUDY ON
'STUDENT-TEACHER INTERACTION'.

DATE

Darrell Fisher
DR DARRELL FISHER

Appendix G
A Typical School Building



Appendix H

Classroom in Progress



